An Evaluation of Algebra Nation in South Carolina

2017-2018

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12/28/2018

Table of Contents

Suggested Citation:

Dickey, E. (2018). An Evaluation of Algebra Nation in South Carolina: 2017-2018. South Carolina Education Oversight Committee. Unpublished Manuscript.

List of Figures

List of Tables

Executive Summary

A comprehensive, yearlong **evaluation** of Algebra Nation use and impact in South Carolina was **conducted by an independent team of educators under contract with the South Carolina Education Oversight Committee** as directed by the General Assembly in the annual general appropriation acts for Fiscal Years 2017-2018 and 2018-2019**.** The evaluation of Algebra Nation as implemented in school year 2017-2018 gathered data on:

- **student achievement** as measured by the state's End-of-Course Algebra 1 examination to examine how Algebra Nation access or use might have impacted test scores;
- **teachers' use and opinions** of Algebra Nation resources through a survey; and
- **how algebra** in middle and high schools **was actually taught and learned** with Algebra Nation through classroom observations.

The evaluation report begins with a **description of Algebra Nation** and documents **how Algebra Nation was implemented** in the state's schools during the 2017-2018 school year. A **description of the methodologies and measurement instruments** used to answer six research questions for this evaluation is provided followed by the **data and results gathered with discussion and conclusions**. **Recommendations are provided** in the final section. An Appendix includes a copy of the teacher survey used, the classroom observation instrument, and the reports for each of the classroom observations.

While Algebra Nation was made available to all South Carolina school districts including online and charter schools**, 70 districts and charter schools made it available to students and teachers in 2017-2018 and of those districts actual usage varied significantly**. The evaluation focused on the 63 traditional school districts. There was evidence that many with access to the resources actually used them sparingly, but there was also evidence that particular teachers made extensive and consistent use. Results from a sample of 97 teachers that used Algebra Nation extensively and with fidelity as well as a subsample of 60 teachers who also taught algebra at the same school during the prior school year used to examine impact on test scores.

The **results** indicated the following about test performance:

- scores on the End-of-Course Algebra 1 examination for students whose teachers used Algebra Nation materials actively and with fidelity over the 2017-2018 school year remained constant while the statewide average dropped one point;
- for teachers using Algebra Nation materials actively and with fidelity, middle school, Algebra 1, and Black/African-American students experienced increased scores; however, high school, Intermediate Algebra, and four other culture/race group students experienced decreased scores;
- districts with access alone to Algebra Nation did not experience test score gains from the prior year;
- students in schools with access to Algebra Nation did not perform better than districts without access; and
- further study related to individual student usage of Algebra Nation is needed to determine impact on test scores.

Because use of Algebra Nation materials was voluntary and determined by individual teachers, **access alone was not sufficient to determine effectiveness.** Teachers with evidence of high levels of student usage were identified for comparison of test scores from the prior year. Also, results from a 50-item examination administered on a single day near the end of the school, while important and influential, do not alone provide sufficient impact evidence.

Data gathered from a survey of teachers using Algebra Nation as well as classroom observations of teachers' use with students indicated that the **materials positively impacted the rigor and quality of instruction.** Teachers cited many examples of why the use of Algebra Nation:

- enhanced their teaching;
- helped them raise expectations;
- influenced them to implement more rigorous instruction; and
- motivated their students to learn algebra.

Teachers also cited how Algebra Nation materials allowed them to provide meaningful instruction for periods of time when school was cancelled or when they were absent for health or professional reasons.

Classroom observations documented how the use of Algebra Nation materials impacted teachers' attention to mathematical practices addressing reasoning, conceptual understanding, applied problem solving, and mathematical representations in a manner that encouraged students' active engagement and cooperation. Teachers were also observed using a variety of instructional approaches in a manner that differentiated among the needs of their students including those whose primary language is Spanish. Data from the observations and the survey indicated that teachers considered Algebra Nation to be a valuable partner in the teaching of algebra. Observations also documented how teachers developed new knowledge and skills through the use of the Algebra Nation materials.

If the sole goal for implementing Algebra Nation as part of South Carolina secondary school algebra learning was to increase EOCEP Algebra 1 examination scores, there was little evidence that such an increase occurred during the first year of implementation. **The scores, for the most part, did not drop as much as the total state average from the prior year, but gains were modest and limited to particular groups and schools. However, there was evidence that teaching improved as did learning that might not be measured by the EOCEP examination particularly after only one year of use.**

Overall, the **results of the evaluation provide evidence that the use of Algebra Nation as part of middle and high school algebra instruction shows promise and therefore should continue.** The test performance when the materials were used actively yielded sufficiently positive results to suggest that test score gains, improved instruction, and student motivation increases are likely to be experienced as teachers make more use of Algebra Nation. Also, **80% of the surveyed teacher respondents felt that the use of the Algebra Nation materials had a positive impact on their students' learning of algebra**, and **90% of teachers surveyed felt that providing South Carolina teachers with access to Algebra Nation should be a high or moderate priority**. South Carolina algebra teachers invested time and effort toward learning about and using Algebra Nation during the first year it was made available. Interest in and use of this resource is growing during the second year. With test score gains for particular groups and very positive feedback from teachers and through observations during the first year, continuing to provide Algebra Nation is recommended.

Test scores and student usage of Algebra Nation from the current year of implementation (2018-2019) should be examined to determine if gains are realized for schools and districts using the resource.

What is Algebra Nation?

Algebra Nation is a set of curriculum materials developed to improve student achievement in a first-year secondary school course addressing algebra, typically a course called "Algebra 1" and required for graduation from high school and admission to college. The six key components of Algebra Nation are:

1. Video Instruction
2. Printed Workbook
3. Test-Yourself! Practice Tool
4. Algebra Wall
5. On Ramp to Algebra (Adaptive Pre-Algebra Learning Tool)
6. Teacher Area

Algebra Nation was developed collaboratively by the Lastinger Center at the University of Florida and Study Edge, a Florida-based educational technology company, beginning in 2012. It was first used in the state Florida in 2013 and now is also used in Alabama, Mississippi, Michigan and New York City as well as in South Carolina. Materials based on the Algebra Nation concept and components are being developed for high school Geometry and Algebra 2 courses as well as for grades 6, 7, and 8 middle school mathematics.

The electronic Algebra Nation materials can be accessed on computers (desktop or laptop), tablets, or smartphones using Windows, Macintosh, Android, and iOS systems. Internet access is required though some materials including videos can be downloaded for viewing or use when Internet access is not available. A printed Workbook is provided to students and teachers in support of electronic materials.

Video Instruction

Videos are offered by six different "Study Experts" who serve as instructors addressing algebra content aligned to South Carolina Algebra 1 Standards. The instructors represent different gender, racial, and ethnic groups and provide instruction using distinct teaching styles, pacing, and personalities as depicted in **Figure 1** on the following page that provides guidance on selecting a study expert. Teachers or students are able to choose from among the different instructors addressing the same algebra content. One Study Expert offers instruction in Spanish. Videos for one study expert (Zach) are closed captioned providing access for hearing impaired or those wanting written explanation. Algebra content includes procedural skills, conceptual understanding, and real-world applications. The video instruction provides for differentiated or independent learning. Students are able to watch videos individually at home or in school, or teachers might show or assign videos as part of classroom instruction.

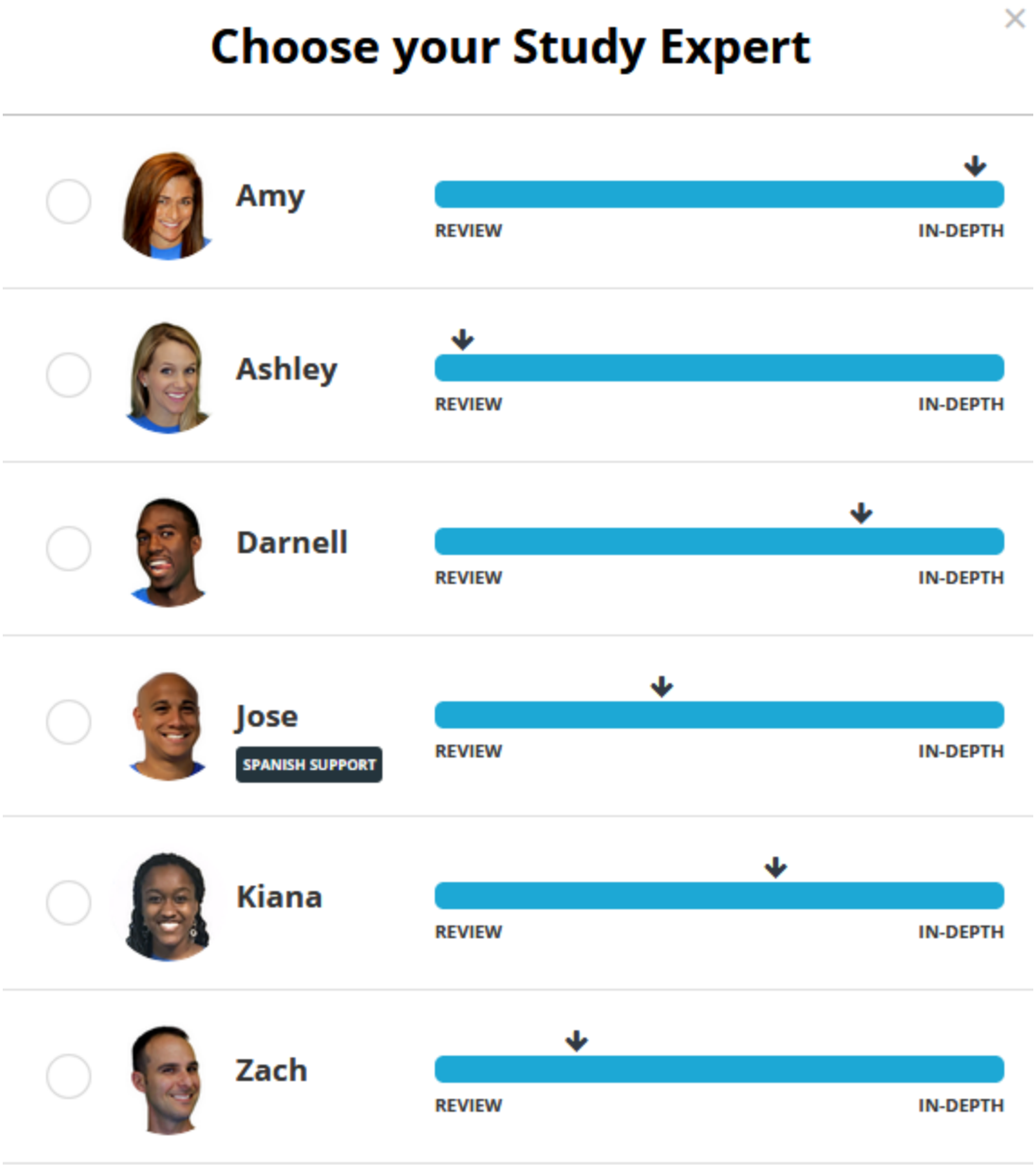


Figure 1: Study Experts

Videos are provided in folders with a "Start Here" set (with a welcome video and handouts for families or students) followed by nine content sections. A "Wait! There's More!" section includes videos and other resources. Each folder includes a copy of the associated Workbook pages, the topics for that section with reference to the associated Workbook pages, and a link to the appropriate Test Yourself Practice Tool. The nine algebra sections are titled:

1. Expressions (9 topics)
2. Equations and Inequalities (9 topics)
3. Introduction to Functions (9 topics)

4. Linear Equations, Functions and Inequalities (10 topics plus topic on direct and inverse variation)
5. Quadratic Equations and Functions Part 1 (10 topics)
6. Quadratic Equations and Functions Part 2 (8 topics)
7. Exponential Functions (6 topics)
8. Summary of Functions (4 topics)
9. Two-Variable Statistics (5 topics)

During the 2017-2018 school year, there were approximately 24 hours of video lessons per Study Expert that cover 62 topics with a total of nearly 150 hours of video instruction. Videos to support the Test Yourself solutions and help, On Ramp, Boot Camp, glossaries and other resources brought the total to over 500 hours. Access to the videos required a username and password.

Printed Workbook and PDF Notes

A Workbook consistent with the instructional videos provided teachers and students with paper resources on which to write and practice algebra work seen and heard on the videos. The workbook content was reviewed by a team of South Carolina mathematics educators including high school teachers of algebra and college mathematics education faculty members to ensure the material is consistent with the South Carolina Algebra 1 Standards. Answer keys for the workbook problems were provided as a separate file in the Teacher Area.

For 2017-2018, the workbook was 224 pages in length and had 9 sections addressing each of the topics for which there are videos. A Braille version of the workbook was also made available to schools. Workbooks included an index that provided the particular section number and topic that addressed each of the South Carolina College and Career Ready Standards for Algebra 1. Each standard was addressed by at least one topic but most were addressed by several. South Carolina Algebra 1 standards were also listed at the beginning of the section addressing them. Some of the Workbook examples and problems used contexts specific to the state of South Carolina, such as references to cities, schools, companies, sports teams, and other local entities.

Test-Yourself! Practice Tool

Test questions similar to those used on standardized algebra tests including the South Carolina End of Course Examination Program (EOCEP) Algebra 1 examination were provided online to allow students to practice responding to questions based on what was learned through regular classroom instruction, video lessons, or workbook use. Reports on students' performance were available to teachers and responses to practice test questions were linked to video instruction for the concept tested.

The Test Yourself Practice was included at the end of each of the nine sections containing the instructional videos. Ten questions are generated for the particular topic section with a review of the answers given by the student after the ten responses are entered. A calculator is sometimes provided. Selected-response items with 4 or 5 alternatives are used as are some constructed-response items. There are over 500 items adapted to test the nine topic sections.

Algebra Wall

The Algebra Wall serves as an online community resource for students to pose questions, seek help, or provide help to others. The Wall was available 24/7 and monitored by the Study Experts and other Algebra Nation staff members. Questions about homework problems or concepts were common. Peer instruction built a sense of community and supported both those who posted questions as well as those providing responses. Algebra Nation monitored usage with a "Leaderboard" and provides rewards for students who were most active as measured by "Karma Points."

An example of interaction among students is provided in **Figure 2** below where a student asks about how to solve an equation, two other students provided assistance, and a Study Expert praises the work:

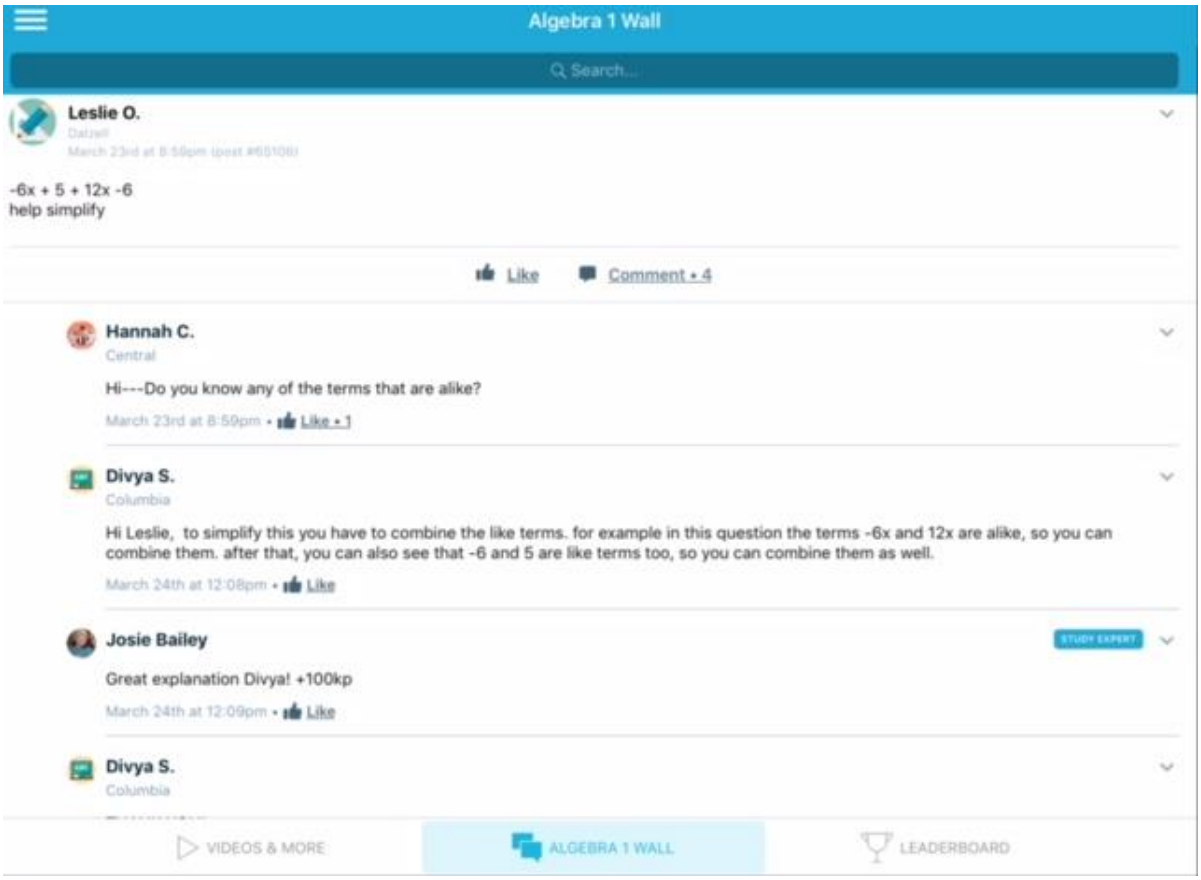


Figure 2: Algebra Wall Example

On Ramp to Algebra (Adaptive Pre-Algebra Review)

Diagnostic assessment tools made up the On Ramp to Algebra. These tools could be used to identify content deficiencies in areas such as fraction arithmetic or algebra terminology and provided students and teachers with information about concepts to be mastered for success in algebra. A total of 121 concepts were tested with reports on progress provided over five content domains: Number and Quantity, Number Systems, Algebra, Functions, and Probability and Statistics all addressing mathematics standards from grades K-8. A Boot Camp resource with sample multiple-choice and constructed-

response questions specific to South Carolina standards was provided at the end of the 2017-2018 school year. Each question was followed by a short video that provided explanations and the answers to the questions.

Teacher Area

The teacher area included resources such as glossaries, content scope and sequence information and alignments, reports about students' usage of Algebra Nation resources and progress, as well as a Teacher Wall that served as a communication and help medium. Over the school year, teachers posted questions, requested help, or offered observations. Examples of postings included pictures of student work, resources tied to practice for tests, questions about locating resources, or requests for assistance with technical problems. All post were monitored and responded to by Algebra Nation staff. **Figure 3** provides an example of a Teacher Wall posting of a teacher sharing an idea with another responding.

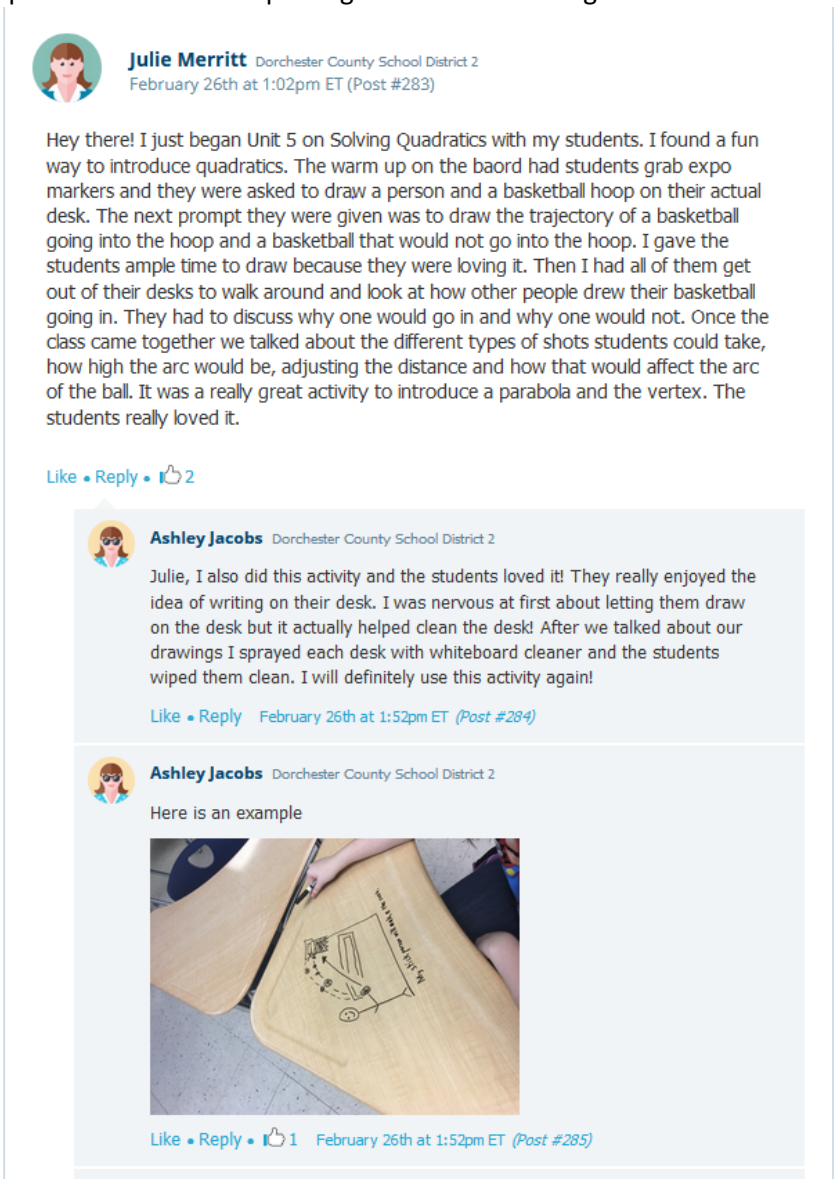


Figure 3: Teacher Wall Example

As illustrated in **Figure 4**, Teacher Resources provided by Algebra Nation included a "Getting Started" folder with videos providing an overview of Algebra Nation and the On Ramp as well as PowerPoint presentations on algebra class integration, a lesson plan template, refection questions, and resources from inquiry-based discovery lessons. A folder with "Resources for Students and Families" with a Community Service poster, a "parent night" PowerPoint presentation, and an Algebra Nation Scavenger Hunt with answer key was also included. A video for using Desmos, a free web-based graphing calculator, was provided. There was also a Reports section that provided data and analytic tools about students' work for students associated with a particular teacher or class section.

Word and Portable Document Format (PDF) files were provided online so that teachers could print or modify materials for use in support of lessons. Independent practice files were provided for each topic within each section, and a separate file with answers was also available. Mini Assessments, Activities with Lesson Plans, and Student Learning Plan form files for each section and topic were provided. Resources for 19 summer school algebra lessons what include a PowerPoint for each lesson followed by activities, games, and assessments were included.

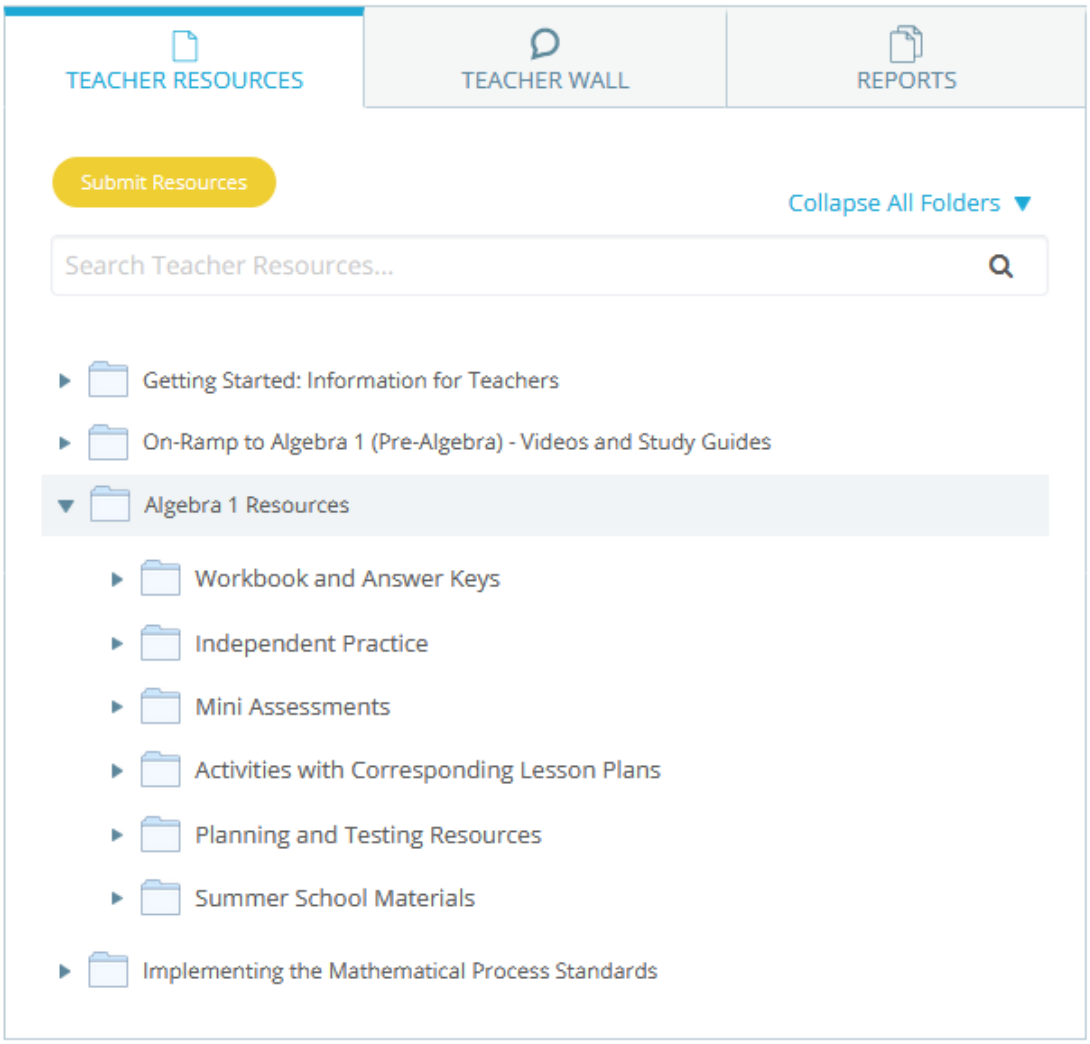


Figure 4: Teacher Resources Example

Over 740 files were provided.

The Reports section provided teachers with numerous options for generating reports based on their students' use of Algebra Nation resources. The reports allowed teachers to use students' results for grading purposes, to gain feedback about student learning or progress that guided instruction, and to make individualized assignments for particular students, for student groups, or for an entire class.

During the summer of 2017 and throughout the 2017-2018 school year, Algebra Nation staff provided professional development sessions for teachers in school districts choosing to implement Algebra Nation. As part of the professional development, five methods of implementation were suggested:

1. using the videos as a virtual co-teacher during class and pausing to elaborate on some concepts or having students collaborate with their shoulder partner to work through questions;

2. showing videos while students followed along to complete their workbook sections when the teacher was absent, so no plans had to be created for a substitute preventing students from missing a day of learning;

3. assigning the Test Yourself! Practice Tool as homework and having students self-assess, working through solution videos to build up the skills they were still working on;

4. encouraging students to download the Algebra Nation mobile app and use the Student Wall when they were working on their homework, so they could get their questions answered even if they are not at school; and

5. supporting each student in setting personal goals to work through the On-Ramp tool, so students could fill in the gaps they need to be successful in Algebra 1.

South Carolina Implementation

Timeline

During the Spring of 2017, staff members from the Education Oversight Committee, the South Carolina Department of Education, and Algebra Nation began discussions about the launch of Algebra Nation and providing access to all South Carolina schools. Plans were made to announce the resource during Summer 2017 and to begin work on teacher professional development as well as on addressing the technical access requirements by schools. Amy Adams, a Study Expert and former mathematics teacher in Florida, was assigned to work with South Carolina teachers beginning in June and Chris Smith, another former mathematics teacher, was added in September. Ms. Adams and Mr. Smith provided teacher professional development sessions for groups and also visited schools and teachers throughout the state providing support either in person or electronically.

August 1, 2017, was the official launch date but significant training and support work began in May 2017. Schools were given access to the Algebra Nation resources but usage was voluntary with decisions on how or when to use Algebra Nation left to teachers or districts to determine. Algebra Nation access was integrated into the data system of each school district agreeing to implementation.

Schools and districts were provided with opportunities to train teachers during the summer and into the school year. Any teacher teaching Algebra 1 in middle or high school or Foundations of Algebra or Intermediate Algebra was encouraged to access and use Algebra Nation materials. Students at schools with access were free to use the materials as part of any class or outside of school. Algebra Nation was offered as a supplementary resource to complement districts' algebra curriculum. Use by teachers was voluntary and access by students and teachers inside and outside of school was offered.

Implementation Data

By the end of September 2017, 57 school districts had access to Algebra Nation resources and by January 31, 2018, a total of 63 South Carolina school districts plus the South Carolina Public Charter School District and schools operated by the Department of Juvenile Justice had full access as well as 5 charter or online schools. All South Carolina school districts were offered access but 18 districts either did not respond to requests for providing access or determined that their instructional plans for Algebra 1 were served by other resources.

A total of 70,000 printed Workbooks were provided to students in participating schools and districts. This is exceeds the 60,489 students statewide who took the Ed of Course Algebra 1 Examination in 2017-2018. Training sessions for 1,225 teachers at 100 sessions were held. Videos in Spanish were made available in November 2017 and a Braille version of the Workbook was provided in February 2018.

By May 30, 2018, Algebra Nation reported the data in **Table 1** for student and teacher "logins" (number of times accessing Algebra Nation resources), "unique logins" (number of individuals accessing Algebra Nation resources, and the total of number of times videos were viewed.

Table 1: Algebra Nation Usage in South Carolina 2017-2018

Total Student Logins	360,030
Total Teacher Logins	51,810
Unique Student Logins	40,016
Unique Teacher Logins	2,182
Total Video Views	493,550
Total Spanish Video Views	8,359

Source: Stephanie Cugini Algebra Nation Usage Report – South Carolina 8/1/17 – 5/30/2018

The number of teachers logging in to Algebra Nation (2,182) exceeded the number of teachers whose students took the 2017-2018 EOCEP Algebra 1 examination (1,535) as well as the number of teachers from districts agreeing to implement Algebra Nation (1,224). This was a result of teachers who teach other subjects having access to Algebra Nation materials. Also, since 60,445 students took the EOCEP Algebra 1 examination, based on unique student logins, approximately 66% or 2 of every 3 South Carolina algebra students had access to Algebra Nation. The total logins do not represent the number of students viewing videos as part of whole-class instruction. For example, a teacher might login and allow 25 students in her class to view the video. Data from the teacher survey administered as part of this evaluation (Question 5 reported in the **Results** section of this report) indicated that up to 54% of responding teachers showed videos to their entire class at least once, and 23% did so at least weekly.

As depicted in **Figure 5**, video viewing trends indicated between 25,000 and 70,000 videos were viewed by students per month during the school year with the most views near the end of the semester or school year.

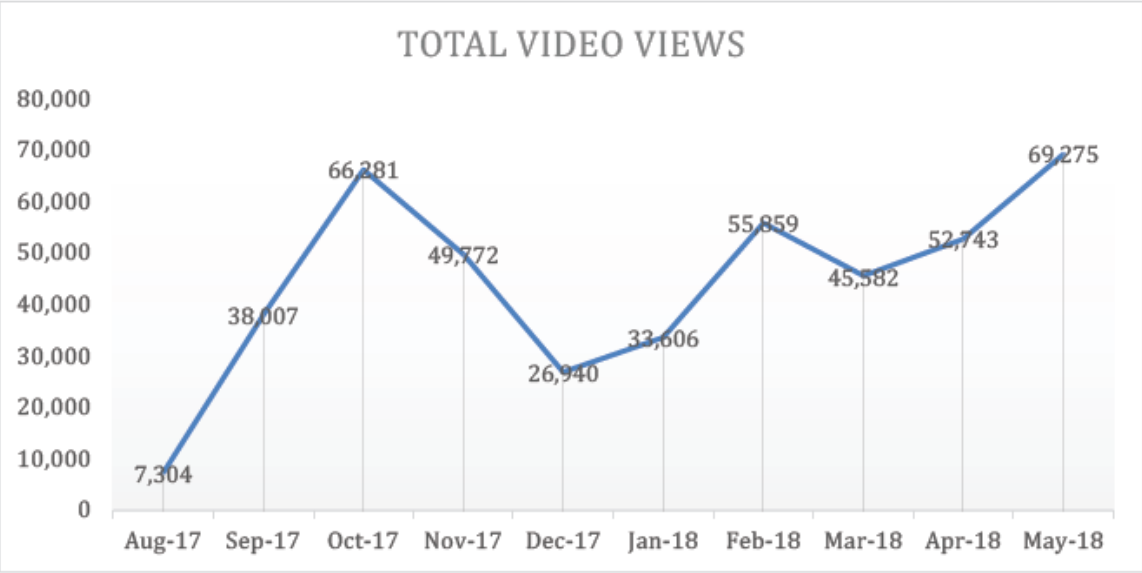


Figure 5: Total Video Viewing 2017-2018
Source: Stephanie Cugini Algebra Nation Usage Report – South Carolina 8/1/17 – 5/30/2018

Figure 6 represents data on monthly student logins ranging from approximately 25,000 to 60,000 per month and peaking in October 2017.

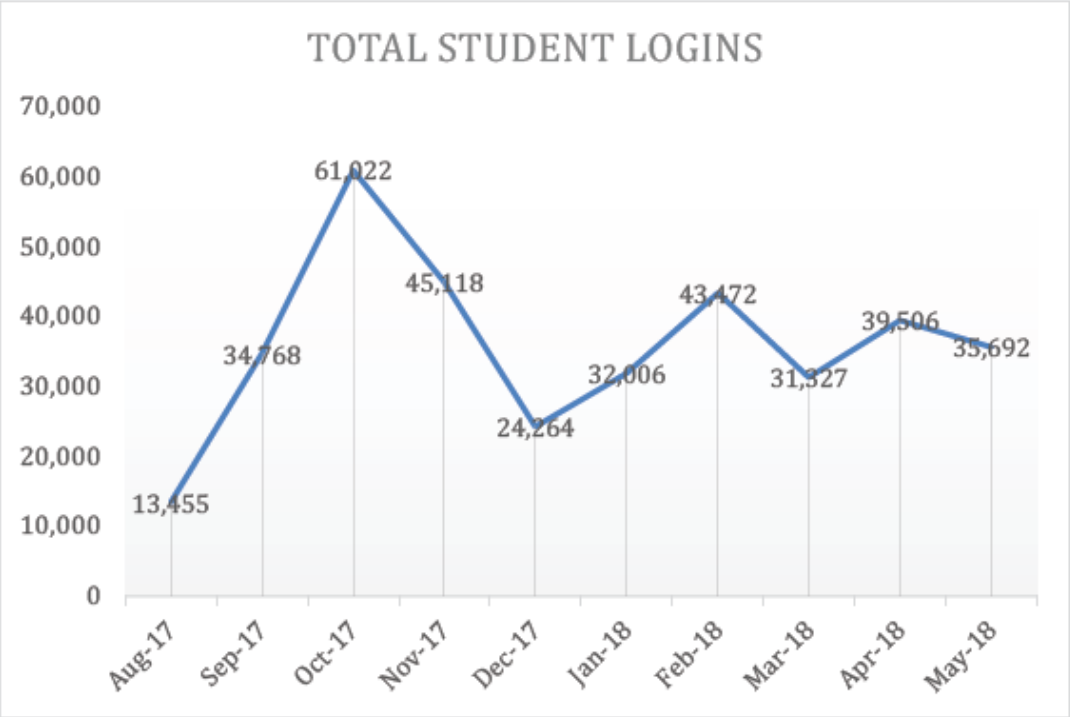


Figure 6: Total Student Logins 2017-2018.
Source: Stephanie Cugini Algebra Nation Usage Report – South Carolina 8/1/17 – 5/30/2018

Usage data from Algebra Nation for 2017-2018 indicated that while some 140,000 access accounts were provided, as many as 64% (89,300) never logged into Algebra Nation and of the 36% that did use the resources, active use such as logging in and viewing videos was evident for about half of that group (25,000). With just over 60,000 students taking the End of Course Algebra 1 examination in 2017-2018 intended and beneficial flexibility of using Algebra Nation materials did not ensure that access to the resources resulted in use.

Evaluation Scope and Methods

Scope of the Evaluation and Research Questions

Impact on the End-of-Course Algebra 1 Examination.

The primary and fundamental question to be answered by this evaluation was:

1. **Does access to or use of Algebra Nation materials positively impact the performance of South Carolina students in Algebra 1 and Intermediate Algebra courses on the End of Course Education Program (EOCEP) Algebra 1 examination?** Specifically, do students with access to Algebra Nation materials, on average, score higher than those without access or higher than comparable students from the prior year? Do students whose teachers use Algebra Nation materials with fidelity score higher than comparable students from the prior year?

The evaluation also sought and analyzed data that would answer the following two questions:

2. Do EOCEP Algebra 1 examination scores suggest a differential impact of Algebra Nation materials on South Carolina student subgroups (e.g. White-Black-Latino, ELL-NonELL, middle-high, Algebra 1-Intermediate Algebra, male-female)?

3. Are there component parts of Algebra Nation (e.g., videos, test practice tool, Algebra Wall) that have a higher association with student performance on the EOCEP Algebra 1 examination than the other components?

To evaluate these research questions, data on the 2016-2017 and 2017-2018 administrations of the EOCEP Algebra 1 examination were gathered from the publicly released results provided by the South Carolina Department of Education. Results from the 2017-2018 EOCEP Algebra 1 examination for districts with access to Algebra Nation were compared to their respective 2016-2017 results. Scores from 2017-2018 for districts without access to Algebra Nation were compared to those with access.

A sample of teachers from different schools and districts for whom there was evidence of consistent and faithful use of Algebra Nation was identified. The results on the EOCEP Algebra 1 examination for those teachers were compared to scores from the prior year for the entire school during the prior year. Also, a subsample of the teachers using Algebra Nation with fidelity, but also teaching algebra at the same school both in 2016-2017 and 2017-2018 was identified to compare students' test scores from both years.

Data about student subgroups were used to analyze differential impact. Data on usage of Algebra Nation by teachers and by students was secured from the Algebra Nation staff. Education Oversight Committee staff provided students' test score results by teacher from 2016-2017 and 2017-2018. Analysis was performed to determine the degree to which usage of different component parts of Algebra Nation related to examination scores. The sample of teachers using Algebra Nation with fidelity was used for examining test scores of student subgroups (e.g. White-Black-Latino, ELL-NonELL, middle-high, Algebra 1-Intermediate Algebra, male-female) as well as to examine the relationship between test scores and different Algebra Nation components (e.g., videos, test practice tool, Algebra Wall).

Impact on teachers.

Related to teaching and classroom learning the evaluation sought and analyzed data to answer the following three questions:

1. Do teachers perceive that particular component parts of Algebra Nation (e.g., videos, online help, Algebra Wall) impact student performance on the Algebra 1 EOCEP greater than others?

2. What types of student or teacher engagements with the different components of Algebra Nation are required in order to impact student performance in Algebra 1?

3. Do South Carolina teachers of Algebra 1 whose students use Algebra Nation materials consider the materials useful to their work?

To evaluate these research questions data were gathered using a statewide survey of Algebra Nation using teachers as well as a set of classroom observations conducted by the researchers. Results of the survey and observation were analyzed and reported.

Methods, Sample, and Instruments

Methods and sample.

To address the primary research question and the additional two questions tied to students' performance on the EOCEP Algebra 1 examination, data were gathered to identify South Carolina schools and districts that had access to Algebra Nation as well as teachers in schools that not only had access to Algebra Nation materials, but also implemented usage with students with demonstrated fidelity and consistency over the 2017-2018 school. Districts that had access to Algebra Nation comprised the group called "**Districts with Access to Algebra Nation**" or **DA**. There were 63 school districts in this group.

A subgroup of the Algebra Nation using districts and schools for which there was evidence of consistent and meaningful usage over the 2017-2018 school year by particular teachers within the schools made up a group called "**Teachers Using Algebra Nation with Fidelity**" or **TUF**. Fidelity was defined to mean that Algebra Nation was used by teachers consistently over the school year and in a manner that addressed the mutual goals of meeting South Carolina College and Career Ready Algebra standards and learning algebra as intended by the Algebra Nation initiative. Consistent use was determined by student and teacher usage data provided by Algebra Nation staff. Teachers in the TUF group had student usage above 1400 as sum of all eleven usage variables for students or 150 as the sum of all twelve usage variable for teachers. The teachers in districts and schools using with fidelity were also informed by information gathered by the research team and Algebra Nation professional development staff. There were 27 districts and 45 schools (29 high schools and 16 middle schools) in this group with 97 teachers (75 from high schools and 22 from middle schools) represented. Scores for the students of teacher in the TUF sample from 2017-2018 were compared to the scores for entire school during the prior year.

To more carefully compare results, a subsample of the TUF teachers was identified consisting of the teachers who taught algebra in both the 2017-2018 school year and the prior year at the same school. There were 22 districts and 34 schools (22 high schools and 12 middle schools) in this group with 60

teachers (43 from high schools and 17 from middle schools) represented. Scores from 2017-2018 for the students of teachers in this subsample of the TUF group were compared to the scores of students during the prior year taught by the same teachers at the same school.

Just over 2,000 middle and high school teachers in the DA group had access to Algebra Nation, but many teachers whose students accessed Algebra Nation were not algebra teachers and many used the resources seldom or inconsistently. For this reason, the scores for the 97 teachers in the TUF group and for the 60 teachers in the subsample group were used to ensure that meaningful Algebra Nation usage occurred.

Districts that did not have access to Algebra Nation were also identified and called "**Districts without Access Algebra Nation**" or **DNA**. There are 18 districts in this group. It must be noted that the two groups (DA and DNA) were not comparable academically as the DNA group had higher mean test scores on the EOCEP Algebra 1 examination in the 2016-2017 school year than the DA group.

The use of Algebra Nation materials, by design, is intended to be flexible. While access is provided to students and teachers, the decisions on how and when to use the materials as well as which of the components to use rested with teachers and their students sometimes with guidance from district level mathematics leaders. For this reason, there was no assurance that teachers or students with access to Algebra Nation actually used the resources particularly in a manner that might impact learning or test scores. In fact, data provided by Algebra Nation staff indicated that many teachers with login credentials seldom made use of the resources. For this reason, the identification of the TUF group that had evidence of usage was determined to be the best method for evaluation impact. The evaluator was not able to match individual student test score performance to students' Algebra Nation usage because test score data with student identification could not be released for public research purposes by the South Carolina Department of Education. Student identifiable data could be released by individual districts, but a pilot study conducted after the Fall 2017 semester proved that not all districts would respond and even when they did, the match of student data was not always achievable.

Table 2 lists the districts comprising the three sample groups (DA, TUF, and DNA) with the TUF group in the middle column listing schools identified for each district and those in *italics* having teachers who taught algebra at the same school the prior year:

Table 2: Sample Groups for Evaluation

Districts with Access to Algebra Nation (DA)	Districts/Schools for Teachers Using Algebra Nation with Fidelity (TUF)		Districts without Access to Algebra Nation (DNA)
Abbeville	*Aiken*	*Midland Valley High School*	Anderson 3
Aiken	*Anderson 2*	*Belton Middle School*	Anderson 4
Allendale	*Barnwell 19*	*Blackville-Hilda High School*	Anderson 5
Anderson 1	*Beaufort*	*Hilton Head High School* *McCracken Middle School-*	Bamberg 2
Anderson 2	*Charleston*	*RB Stall High School*	Clarendon 1
Bamberg 1	*Cherokee*	*Blacksburg High School*	Clarendon 2
Barnwell 19	*Chesterfield*	*Cheraw High School* McBee High School	Edgefield

Barnwell 29	*Colleton*	*Colleton Co Middle School*	Florence 4
Barnwell 45	*Dillon 4*	*Dillon High School* Lakeview High School	Florence 5
Beaufort	*Dorchester 2*	*Ashley Ridge High School* *Fort Dorchester High School* *Summerville High School* *Gregg Middle School*	Greenwood 52
Berkeley	*Florence 1*	*West Florence High School* *Southside Middle School*	Horry
Calhoun	Florence 3	RE McNair Jr High School	Jasper
Charleston	Greenville	Berea High School	Kershaw
Cherokee	*Greenwood 50*	Greenwood High School *Brewer Middle School* Westview Middle School	Lancaster
Chester	*Laurens 56*	*Clinton High School*	Marlboro
Chesterfield	*Lexington 3*	*Batesburg-Leesville Middle*	Spartanburg 2
Clarendon 3	*Lexington-Richland 5*	*Dutch Fork High School* *Chapin Middle School* Dutch Fork Middle School *Irmo Middle School*	York 3
Colleton	Newberry	Mid Carolina High School	York 4
Darlington	Oconee	Seneca High School	
Dillon 3	*Orangeburg 3*	*Lake Marion High School*	
Dillon 4	Pickens	Pickens High School	
Dorchester 2	*Richland 1*	*AC Flora High School* *Eau Claire High School* *St Andrews Middle School*	
Dorchester 4	*Richland 2*	*Blythewood High School* *Richland Northeast High* E.L. Wright Middle School	
Fairfield	*Spartanburg 6*	*Dorman High School* *Dorman Freshman Campus*	
Florence 1	*Spartanburg 7*	*Spartanburg High School*	
Florence 2	*Sumter*	*Hillcrest Middle School*	
Florence 3	*Union*	*Union County High School* *Sims Middle School*	
Georgetown			
Greenville			
Greenwood 50			
Greenwood 51			
Hampton 1			
Hampton 2			
Laurens 55			
Laurens 56			
Lee			

Lexington 1			
Lexington 2			
Lexington 3			
Lexington 4			
Lexington-Richland 5			
Marion 10			
McCormick			
Newberry			
Oconee			
Orangeburg 3			
Orangeburg 4			
Orangeburg 5			
Pickens			
Richland 1			
Richland 2			
Saluda			
Spartanburg 1			
Spartanburg 3			
Spartanburg 4			
Spartanburg 5			
Spartanburg 6			
Spartanburg 7			
Sumter			
Union			
Williamsburg			
York 1			
York 2			

To address the first and primary research question, seven comparisons of EOCEP Algebra 1 examination results were conducted for different groups within the 2016-2017 and 2017-2018 school years.

To examine differences from previous year (2016-2017) to implementation year (2017-2018) when Algebra Nation was available:

DA2018 to **DA**2017
TUF2018 to **TUF**2017 and *Subsample***TUF**2018 to *Subsample***TUF**2017
DNA2018 to **DNA**2017

To examine differences between districts using or not using Algebra Nation:

DA2018 to **DNA**2018
TUF2018 to **DNA**2018 and *Subsample***TUF**2018 to **DNA**2018

The EOCEP Algebra 1 examination was revised significantly for the 2016-2017 administration because new South Carolina College and Career Ready Mathematics standards had been adopted in 2015 and implemented in the 2016-2017 school year. The results of the 2016-2017 examination were significantly lower than results from past years making the 2016-2017 implementation the only one appropriate for

comparison. The 2016-2017 and 2017-2018 EOCEP examinations were statistically equivalent forms allowing for comparison between years.

Mean scores for the districts were used and the statistical significance of differences was tested using a *t*-test with 0.05 as the significance level that indicates a 95% probability that the differences are not zero.

To address the second research question about differential impact on subgroups of learners, mean scores for the students of teachers using Algebra Nation with fidelity (TUF) for particular subgroups during 2017-2018 were compared to the state means for each of the subgroups. The comparison subgroups for which data were made available included:

- **Gender**: Male and Female
- **English Language**: Limited English Proficient (LEP), Non-LEP
- **School Level:** Middle, High
- **Type of Algebra Course**: Algebra 1, Intermediate Algebra
- **Culture/Race**: Hispanic/Latino, American Indian/Alaska Native, Asian, Black/African American, Native Hawaiian/Pacific Islander, White, Two or more races

Lastly, to address the third research question, 2017-2018 mean scores of students taught by teachers using Algebra Nation with fidelity (TUF) were analyzed to determine the degree to which the amount of usage of different Algebra Nation components were related to the examination scores. Algebra Nation usage by the teachers and by the students was analyzed to identify correlation with EOCEP Algebra 1 test scores. The Algebra Nation components examined from data provided by Algebra Nation staff include the following items for teachers and for students.

Teacher Usage:

- Total number of times the teacher logged in during the course
- Total number of reports the teacher generated during the course
- Total number of times teachers posted to students in the course
- Total number of document downloads by the teacher during the course from the teacher area
- Total number of downloads by the teacher from any area during the course
- Total number of downloads by the teacher of independent practice materials during the course
- Total number of downloads of Mini Assessments by the Teacher during the course
- Total number of times the teacher accessed the system teacher area during the course
- Total number of times the teacher logged on to view videos during the course and during school hours
- Total number of times the teacher logged on to view videos during the course and outside of school hours
- Total number of times the teacher viewed videos more than once during school hours during the course.
- Total number of times the teacher viewed videos more than once outside of school hours during the course.

Student Usage:

- Total number of student Logins
- Total number of student Video views during school hours
- Total number of student Video views outside of school hours
- Total number of Test Yourself completed
- Total number of student Wall Posts during school hours
- Total number of student Wall Posts outside school hours
- Total number of Karma Points
- Number of students that started On Ramp but did not finish
- Number of students that completed On Ramp

Mean scores from 2017-2018 for the students of teachers using Algebra Nation with fidelity (TUF) were correlated with the twelve teacher usage variables as well as the nine student usage variables. Examination score means for students of each teacher were regressed on usage variables to determine the relationship using a correlation coefficient of the different Algebra Nation components (the 21 variables) to these mean scores.

EOCEP Algebra 1 examination.

The 2017-2018 End of Course Examination Program Algebra 1 examination served as the cognitive instrument for measuring South Carolina student achievement in algebra and examining the impact of Algebra Nation on students' examination results.

The End of Course Examination Program (EOCEP) is an assessment program implemented by the South Carolina Department of Education for high school courses in English/language arts, mathematics, science, and social studies (Source: https://ed.sc.gov/tests/high/eocep/) . EOCEP examination results in three areas (English/language arts, mathematics, and science) meet current federal accountability requirements and must be administered to all public high school students by their third year of high school.

The EOCEP Algebra 1 Examination is derived from the 2015-2016 South Carolina College and Career Ready Algebra 1 Standards available at https://ed.sc.gov/scdoe/assets/File/tests/high/eocep/2015-16-Print-SCCCR-Algebra1Stands.pdf . The examination is administered to students enrolled in Algebra 1 or in Intermediate Algebra. The administration is untimed. Algebra 1 may be taken in middle or high school and Intermediate Algebra is intended for high school only and follows a course titled Foundations of Algebra.

A Teacher's Guide and Sample Items 14-page booklet developed the Office of Assessment in the South Carolina Department of Education is provided at https://ed.sc.gov/tests/tests-files/eocep-files/algebra1-teachers-guide-and-sample-items/ . The guide stipulates that the EOCEP Algebra 1 examination consists of 50 items (i.e., test questions) that are described as "multiple-choice or technology-enhanced." The multiple-choice items seem to have four alternatives from which students are to select the one determined to be the correct response. Basic and scientific calculator tools are available of use by students as part of the examination administration as is a graphing tool comparable to a graphing calculator. Students may also use their own graphing calculator if it is not prohibited but must have data cleared.

A "Blueprint" for the 2017-2018 EOCEP Algebra 1 examination is available at https://ed.sc.gov/tests/tests-files/eocep-files/2017-18-algebra-1-test-blueprint/ and indicates that the examination consists of 21 to 25 items addressing Algebra, 18 to 22 addressing Functions, and 8 to 11 addressing Number and Quantity; Interpreting Data.

The results of the EOCEP Algebra 1 Examination contribute 20% in the calculation of a student's grade for either the Algebra 1 or Intermediate Algebra course.

Test results are released to the public by the South Carolina Department of Education and those results were used as part of this evaluation as well as results provided to the research team by staff of the Education Oversight Committee of student scores by teacher.

Statewide means by school and district for the EOCEP Algebra examinations administered in 2016-2017 before Algebra Nation and for 2017-2018 were and are available to the public (https://ed.sc.gov/data/test-scores/state-assessments/end-of-course-examination-program-eocep/) and used as part of this evaluation. Data on the students for teachers in the TUF group for both the 2016-2017 and 2017-2018 administration were made available to the evaluation team for use in the evaluation.

Table 3 contains a summary of statewide means in 2017-2018 and the prior year for all students as well as for different subgroups. It should be noted that the mean score for all South Carolina decreased by 1.00 points from 2016-2017. This change was significant at the 0.05 level (with *p*-value less than 0.0001) indicating that statewide the 2017-2018 population of students performed lower than the population from the prior year on equated forms of the examination.

Table 3: EOCEP Algebra 1 Examination Summary Statistics

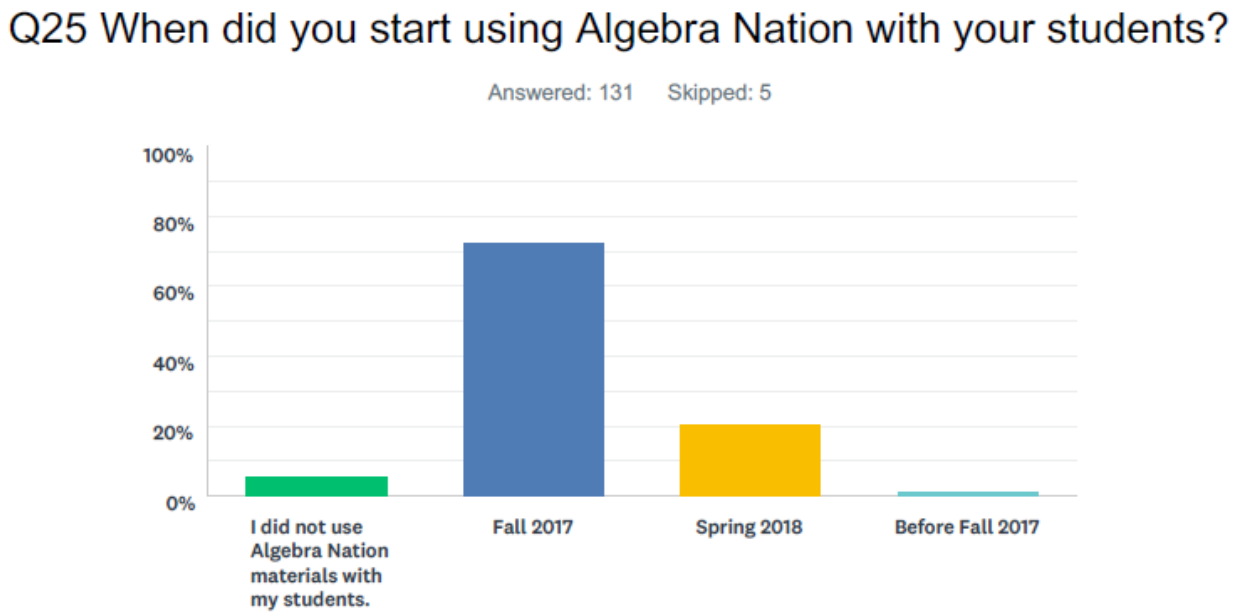
South Carolina EOCEP Algebra 1 Results	2017-2018			2016-2017		
	Mean	SD	N	Mean	SD	N
ALL STUDENTS	68.4	14.9	60489	69.4	13.4	62655
Male	67.3	15.1	31115	68.5	13.5	31962
Female	69.7	14.5	29251	70.4	13.1	30484
Hispanic or Latino	66.4	13.8	5376	67.7	12.5	5088
Amer Indian or Alaska Native	65.8	14.8	195	66.4	12.5	171
Asian	81.7	15.1	979	80.6	14.0	1001
Black or African American	61.6	12.3	19344	63.5	10.8	20638
Pacific Islander or Hawaiian	68.6	13.2	81	72.3	13.3	76
White	72.6	14.7	32115	73.0	13.5	33438
Two or more races	68.8	14.3	2108	69.9	13.3	2002
Limited English Proficient (LEP)	65.8	14.2	4305	66.8	12.5	4008
Non-LEP	68.6	14.9	56184	69.6	13.4	58647
Algebra 1 (4114)	70.9	14.8	48906	71.7	13.4	49603
Intermediate Algebra (4117)	58.6	9.5	10974	61.6	8.6	12281

Teacher survey.

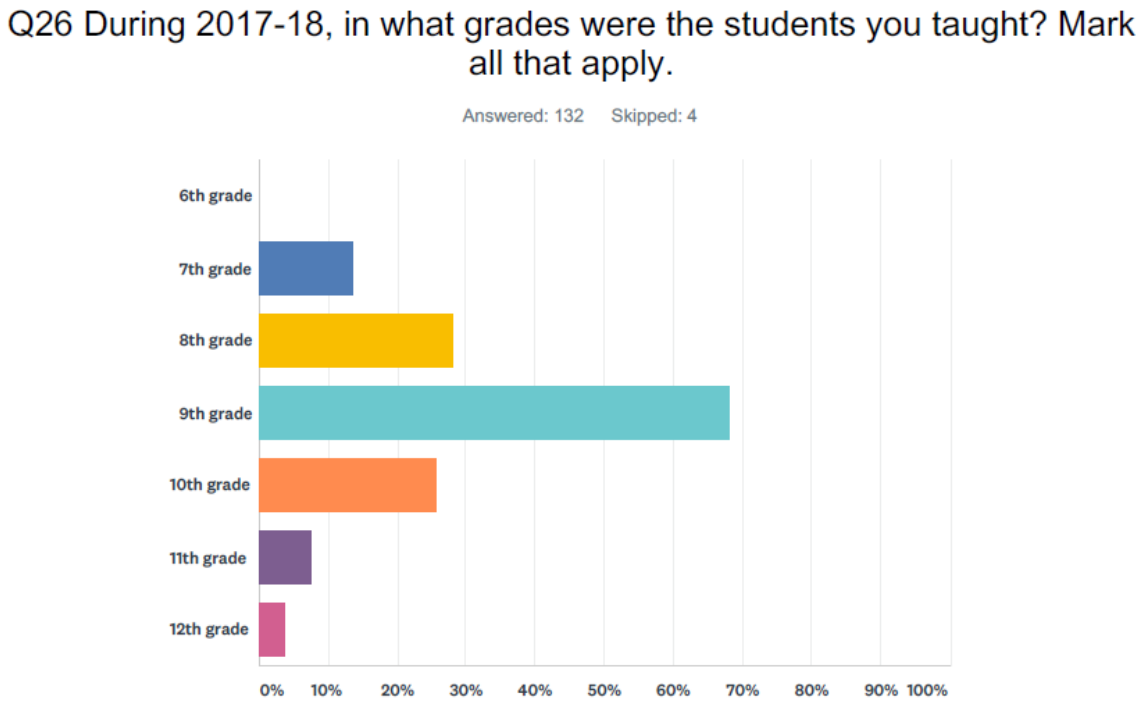
Using a survey developed by Dr. Walter Leite for a Florida evaluation of Algebra Nation, Drs. Dickey and Knight of the evaluation team with input from Algebra Nation staff members developed a revised survey that was used for the South Carolina evaluation. The survey consisted of 31 items and was offered electronically using the SurveyMonkey platform as part of an account registered to the Education Oversight Committee staff. A copy of the entire survey is provided in **Appendix A**.

The survey was launched on April 28, 2018, and closed on June 8. Teachers included in the Algebra Nation data base were invited via email to respond. Links were also included with social media postings and reminders were sent weekly. Mathematics supervisors and members of the South Carolina Leaders in Mathematics Education professional organization were also asked to assist in encouraging Algebra Nation using teachers to complete the survey.

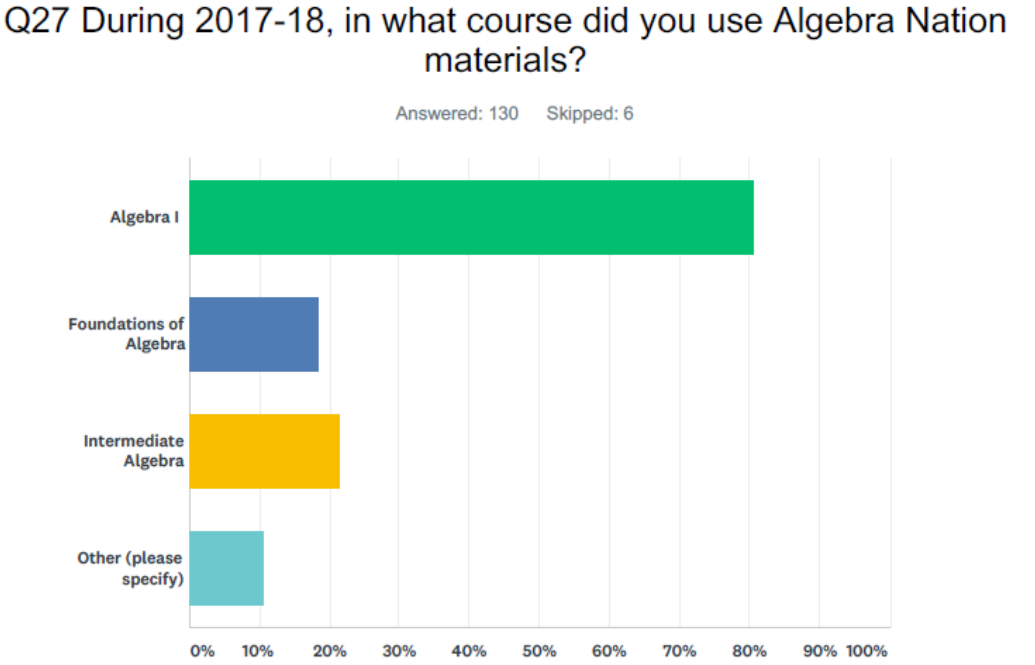
A total of 136 responses from teachers were received. The responses represented approximately 6% of the total number of teachers who were had access to Algebra Nation based on the "unique teacher logins" reported. Six of the survey items (Question 25 to 30) addressed respondent demographics. **Question 25** (or **Q25**) ascertained that only 5% of respondents had not used Algebra Nation, 1.5% or 2 respondents had used it in another state prior to this school year, and 21% only began using the resources during the Spring 2018 semester.



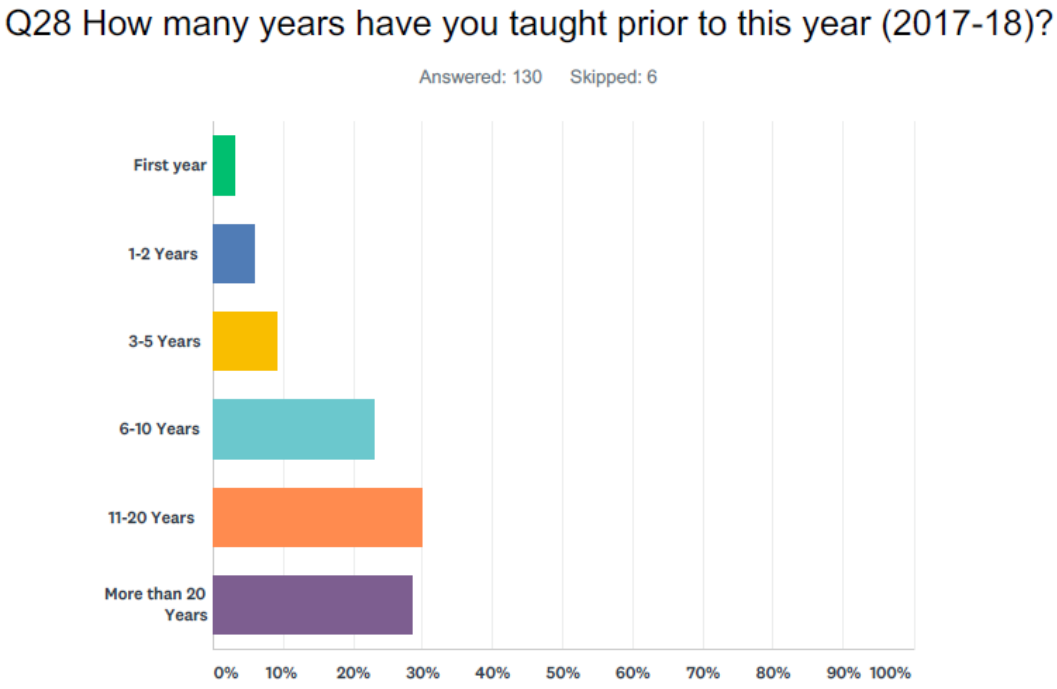
The majority of respondents taught in grade 9 as indicated by the responses to **Question 26**. Teachers of grades 7, 8, 10, 11, and 12 were also represented.



Similarly, in response to **Question 27**, the majority of respondents taught the Algebra 1 course in middle or high school (80%) with approximately 20% teaching both the Foundations of Algebra course and the Intermediate Algebra course. Other courses using Algebra Nation included "Math Essentials" mentioned by 5 respondents and Algebra 2 mentioned by two. Use in other classes like ACT Prep, 8th grade math, or pre-algebra was also cited. The totals and percentages in the graphs summarizing results from Questions 26 and 27 exceed the number of respondents and 100% because respondents were allowed to check as many grades as applied to their situation.



Most respondents were experienced teachers with 11 or more years of experience (58%) as summarized by the responses to **Question 28**. Only four were in their first year of teaching and only 18% had 5 or fewer years of experience. In response to Questions 29 and 30, 19% of respondents indicated that they were National Board Certified Teachers and 11.5% were certified as mathematics teachers through alternative programs such as PACE, ABCTE, or Teach for America).



Class observation protocol.

Class observations were conducted by Drs. Ed Dickey and Rainey Knight. Potential teachers for observation were suggested by members of the South Carolina Leaders in Mathematics Education as well as from Algebra Nation professional development staff. Teachers were contacted by Dr. Dickey and asked to volunteer to be observed. If agreeing, each provided scheduling information for class days and times that would include the use of Algebra Nation as part of algebra instruction.

An observation report with pictures documented the instructional experience. For 8 of the 10 observations, the *Mathematics Classroom Observation Protocol for Practices* (*MCOP*^{2}) instrument was used to measure the degree of alignment of the instruction to various practice standards including the ***South Carolina College and Career Ready Standards for Mathematics*** as well as practices or processes expected in standards promulgated by national organizations such as NCTM. Two of the observations were conducted in November 2017 as part of planned Algebra Nation media events with dignitaries and television cameras in the classroom, so the lessons were not assessed using the observation instrument. A copy of the MCOP^2 instrument is provided in **Appendix B** and the 10 observation reports along with completed MCOP^2 forms are provided in **Appendix C**.

Results

EOCEP Algebra 1 Examination

The tables in this section contain the results on the EOCEP Algebra 1 examination for schools and districts in the three samples identified for this evaluation: **Districts with Access to Algebra Nation** (**DA**), **Teachers Using Algebra Nation with Fidelity** (**TUF**), and **Districts with No Access to Algebra Nation** (**DNA**). Data is also provided for subgroups within the samples including school level (middle or high), course (Algebra 1 or Intermediate Algebra), gender, English Language proficiency, and culture/race. Discussion and conclusions drawn from this data with respect to the first three research questions of this evaluation study are provided in the section that follows.

DA2018 to **DA**2017

Table 4 provides means, standard deviations (**SD**), and numbers of students tested (**N**) from 2017-2018 and from the prior year for school districts with access to Algebra Nation materials along with means for the districts and the statewide means. Access alone did not ensure that usage was active or sustained over the school. (* indicates a statistically significant difference from the prior year.)

Table 4: Statistics for Districts with Access to Algebra Nation

Districts with Access to Algebra Nation (DA)	2017-2018 EOCEP Algebra 1 Results			2016-2017 EOCEP Algebra 1 Results		
	Mean	SD	N	Mean	SD	N
Abbeville	77.5	15.1	189	75.5	13.7	216
Aiken	65.8*	13.4	2097	68.4	11.9	2282
Allendale	56.9	12.5	96	59.5	9.3	79
Anderson 1	72.2	15.8	791	73.3	13.6	774
Anderson 2	62.2	11.6	273	61.8	9.0	169
Bamberg 1	70.5	13.7	92	71.2	14.1	122
Barnwell 19	64.0	12.3	44	62.3	7.1	47
Barnwell 29	62.3*	12.5	82	67.3	11.4	71
Barnwell 45	62.3	12.3	155	65.0	13.6	198
Beaufort	72.2*	14.3	1477	70.0	12.6	1700
Berkeley	68.1*	14.5	2699	69.8	12.3	2737
Calhoun	62.8*	11.0	120	68.3	9.3	93
Charleston	71.3*	15.6	3965	72.4	14.2	3987
Cherokee	65.3*	12.9	650	68.7	12.6	705
Chester	60.8*	11.5	533	64.0	10.8	371
Chesterfield	66.0	14.2	519	67.3	12.7	643
Clarendon 3	67.5	11.8	88	66.7	9.7	131
Colleton	59.5*	12.0	401	63.4	11.3	426
Darlington	63.8*	13.2	778	66.2	10.6	840
Dillon 3	72.4*	11.2	99	66.1	9.6	151
Dillon 4	68.5	12.7	302	67.4	12.1	284

Dorchester 2	70.3	15.6	2084	70.5	13.6	2146
Dorchester 4	61.8	11.3	163	61.8	8.4	166
Fairfield	61.4*	13.1	169	65.6	11.6	201
Florence 1	65.5	13.5	1299	65.6	11.8	1533
Florence 2	67.4*	11.7	100	63.7	11.1	148
Florence 3	59.7*	11.8	181	67.9	11.4	132
Georgetown	64.5	13.1	700	65.4	12.1	865
Greenville	69.9*	15.3	5949	71.8	14.2	6054
Greenwood 50	66.8	14.9	549	67.0	13.5	611
Greenwood 51	60.8*	11.7	56	65.6	10.7	96
Hampton 1	61.5*	11.8	182	70.0	9.8	123
Hampton 2	58.6	12.1	34	60.7	7.7	72
Laurens 55	63.5	13.6	423	64.8	11.9	476
Laurens 56	64.0	11.0	244	63.3	10.8	177
Lee	56.4*	12.1	126	62.0	9.5	140
Lexington 1	71.7*	13.3	2234	72.5	12.8	2185
Lexington 2	64.9*	15.4	579	66.6	13.8	680
Lexington 3	65.8	11.6	147	67.6	10.0	146
Lexington 4	55.3*	12.0	202	58.9	8.9	273
Lexington-Richland 5	73.0	15.3	1482	73.6	12.6	1505
Marion 10	62.0*	11.9	326	65.2	10.4	335
McCormick	58.5	11.7	68	60.1	10.4	52
Newberry	66.4	13.4	409	66.3	12.3	662
Oconee	68.1*	14.0	885	70.3	12.5	801
Orangeburg 3	63.3	9.9	171	63.0	9.2	188
Orangeburg 4	63.0	12.5	270	62.9	10.5	305
Orangeburg 5	59.2*	11.7	434	62.2	11.0	420
Pickens	68.2*	15.5	1159	71.0	14.1	1246
Richland 1	63.4*	15.2	1758	65.5	13.7	1776
Richland 2	70.3	14.8	2224	70.6	12.8	2115
Saluda	64.9	14.3	159	66.0	12.4	207
Spartanburg 1	72.0*	12.9	405	75.4	13.2	459
Spartanburg 3	63.9*	13.2	294	71.6	12.6	251
Spartanburg 4	73.7	15.7	185	75.4	13.1	213
Spartanburg 5	72.0*	13.1	696	73.5	12.5	612
Spartanburg 6	69.2	15.6	1030	70.0	13.4	924
Spartanburg 7	66.1*	14.0	543	69.6	12.6	538
Sumter	61.3	12.8	1221	61.2	11.4	1394
Union	61.8*	13.9	309	64.0	10.9	381
Williamsburg	56.6*	11.5	273	61.1	10.0	281
York 1	65.4*	11.9	418	67.1	11.3	408
York 2	73.6*	14.2	753	75.1	11.9	678
Mean (weighted)for All DA	67.9*	14.2	46343	69.2	12.7	48001
State Mean	68.4*	14.9	60489	69.4	13.3	62655

TUF2018 to **TUF**2017

The 2017-2018 results in **Table 5** represent the means scores, standard deviations, and number tested of students taught by one to six teachers at the listed schools who were selected through usage data and other information for having used Algebra Nation materials with fidelity. The 2016-2017 results are the means, standard deviations, and numbers tested for the schools including all algebra teachers based on all students tested. Means for the sample as well as for students in different school levels and courses are also included at the bottom of the table. (* indicates a statistically significant difference from the prior year.)

Table 5: Statistics for Schools with Teachers Using Algebra Nation with Fidelity

Schools with Teachers Using Algebra Nation with Fidelity (TUF)	2017-2018 EOCEP Algebra 1 TUF Results			2016-2017 EOCEP Algebra 1 School Results		
	Mean	SD	N	Mean	SD	N
Aiken: Midland Valley HS	57.3*	8.4	253	62.7	7.7	321
Anderson 2: Belton MS	74.8	10.0	53	72.9	8.8	73
Barnwell 19: Blackville-Hilda HS	64.4	12.9	52	62.3	7.1	47
Beaufort: HE McCracken MS	93.1*	7.4	64	78.0	10.7	73
Beaufort: Hilton Head HS	68.0	11.7	153	66.9	8.6	205
Charleston: RB Stall HS	62.0	10.2	312	62.3	9.9	338
Cherokee: Blacksburg HS	58.6*	9.6	34	63.9	9.5	143
Chesterfield: Cheraw HS	65.8	13.3	34	62.7	11.8	155
Chesterfield: McBee HS	61.1	12.5	79	62.4	10.8	138
Colleton: Colleton County MS	75.6	10.5	66	78.7	9.2	49
Dillon 4: Dillon High School	61.1	8.5	78	62.2	7.7	131
Dillon 4: Lakeview High School	65.7*	12.8	70	58.6	8.3	54
Dorchester 2: Ashley Ridge HS	67.5	13.0	409	66.6	9.5	508
Dorchester 2: Fort Dorchester HS	67.3	12.3	367	66.1	10.9	456
Dorchester 2: Summerville HS	64.9	11.5	492	65.2	9.1	652
Dorchester 2: Gregg MS	84.8*	10.6	128	81.5	9.1	116
Florence 1: West Florence HS	63.4	11.4	190	62.6	9.2	423
Florence 1: Southside MS	82.6	11.9	41	79.3	10.7	58
Florence 3: RE McNair Jr HS	74.8*	11.9	26	84.0	9.9	22
Greenville: Berea HS	59.1*	8.6	67	64.5	8.6	145
Greenwood 50: Greenwood HS	62.0	10.5	166	61.5	8.5	265
Greenwood 50: Brewer MS	83.6	11.1	68	80.6	9.6	66
Greenwood 50: Westview MS	81.4	10.6	71	82.8	11.7	77
Laurens 56: Clinton HS	59.3	12.6	70	58.6	8.6	13
Lexington 3: Batesburg-Lees MS	73.6	11.9	52	75.4	9.3	52
Lexington 5: Dutch Fork HS	66.2*	9.7	72	69.0	8.2	237
Lexington 5: Chapin MS	85.6	11.0	246	80.6	9.9	255
Lexington 5: Dutch Fork MS	86.0	10.5	22	81.9	10.8	257
Lexington 5: Irmo MS	79.0*	10.0	95	83.3	9.7	144

Newberry: Mid Carolina HS	64.1	10.9	55	63.8	8.9	221
Oconee: Seneca HS	58.0*	8.1	59	64.6	6.9	151
Orangeburg 3: Lake Marion HS	61.2*	9.0	89	64.2	8.9	134
Pickens: Pickens HS	61.7	10.1	134	61.6	7.9	181
Richland 1: AC Flora HS	59.8	11.6	215	59.1	8.5	269
Richland 1: Eau Claire HS	57.5	10.9	73	57.9	7.4	96
Richland 1: St Andrews MS	70.3	9.2	25	73.1	9.0	29
Richland 2: Blythewood HS	63.8*	12.6	43	68.0	8.5	361
Richland 2: Richland Northeast HS	64.4*	13.7	213	68.0	9.9	261
Richland 2: EL Wright MS	94.8*	6.6	16	90.0	6.8	34
Spartanburg 6: Dorman HS	57.3	7.4	71	57.0	7.5	287
Spartanburg 6: Dorman Fresh C	68.1*	12.6	338	72.7	9.5	433
Spartanburg 7: Spartanburg HS	64.7	11.1	201	65.9	8.2	353
Sumter: Hillcrest MS	78.7	13.7	28	77.4	10.7	34
Union: Union County HS	53.6*	9.5	116	61.8	7.7	285
Union: Sims MS	75.5	14.7	71	73.1	10.4	64
Means (weighted) for TUF	67.0	13.9	5586	67.0	11.1	8666
High Schools for TUF	63.5*	11.9	4514	64.5	11.3	7263
Middle Schools for TUF	81.8*	12.2	1072	80.2	10.0	1403
Alg 1 Course for TUF	69.4	14.1	4384	69.2	9.9	6549
Int Alg Course for TUF	58.3*	9.0	1202	60.7	7.7	2087

*Subsample***TUF**2018 to *Subsample***TUF**2017

For the TUF group, data from 34 schools were matched to the same teachers for the prior school year; teachers who were at the same school and taught Algebra 1 or Intermediate Algebra both years. These results, while for a smaller sample, represent the best control of the teacher variable and to some degree student variables. The test score means, standard deviations, and numbers tested in **Table 6** are reported for one or more teachers at the school who taught Algebra 1 or Intermediate Algebra both in 2016-2017 and in 2017-2018 at the same school. Means for the sample as well as for students in different school levels and courses are also included at the bottom of the table. (* indicates a statistically significant difference from the prior year.)

Table 6; Statistics Subsample of Schools with Teachers Using Algebra Nation with Fidelity

Schools with Teachers Using Algebra Nation with Fidelity (*subsample* of TUF)	2017-2018 EOCEP Algebra 1 Subsample TUF Results			2016-2017 EOCEP Algebra 1 Subsample TUF Results		
	Mean	SD	N	Mean	SD	N
Aiken: Midland Valley HS	57.4*	8.5	173	64.9	7.9	189
Anderson 2: Belton MS	74.8	10.0	53	72.9	8.8	73
Barnwell 19: Blackville-Hilda HS	64.4	12.9	52	62.3	7.1	47
Beaufort: HE McCracken MS	93.1*	7.4	64	81.2	13.4	94
Beaufort: Hilton Head HS	61.9	7.7	50	63.2	5.6	38
Charleston: RB Stall HS	63.6*	10.2	241	67.6	9.1	99
Cherokee: Blacksburg HS	58.6	9.6	34	57.5	9.3	41
Chesterfield: Cheraw HS	65.8	13.3	34	63.6	11.4	147
Colleton: Colleton County MS	75.6	10.5	66	78.7	9.2	49
Dillon 4: Dillon High School	61.1*	8.5	78	66.2	10.4	97
Dorchester 2: Ashley Ridge HS	63.4	11.3	236	64.0	7.9	216
Dorchester 2: Fort Dorchester HS	67.8	12.3	250	67.6	11.5	323
Dorchester 2: Summerville HS	65.9*	11.8	390	64.4	9.9	414
Dorchester 2: Gregg MS	84.8*	10.6	128	81.5	9.1	116
Florence 1: West Florence HS	63.4	11.4	190	64.9	10.8	151
Florence 1: Southside MS	82.6	11.9	41	84.4	10.0	32
Greenwood 50: Brewer MS	83.6	11.1	68	80.6	9.6	66
Laurens 56: Clinton HS	59.3	12.6	70	55.6	7.4	40
Lexington 3: Batesburg-Lees MS	73.6	11.9	52	75.4	9.3	52
Lexington 5: Dutch Fork HS	64.4*	9.2	40	70.6	9.8	56
Lexington 5: Chapin MS	85.8*	11.1	225	80.6	9.9	255
Lexington 5: Irmo MS	79.0	10.0	95	80.7	9.2	74
Orangeburg 3: Lake Marion HS	64.1	9.1	37	66.0	9.5	48
Richland 1: AC Flora HS	55.1	9.4	40	55.4	7.8	37
Richland 1: Eau Claire HS	56.6	10.1	45	59.9	7.4	48
Richland 1: St Andrews MS	70.3	9.2	25	72.6	10.2	18
Richland 2: Blythewood HS	63.8*	12.6	43	71.2	8.5	57
Richland 2: Richland Northeast HS	67.7	15.2	111	65.0	8.9	93
Spartanburg 6: Dorman HS	58.7	4.3	22	56.6	9.2	18
Spartanburg 6: Dorman Fresh C	69.3*	12.6	174	72.9	9.2	178
Spartanburg 7: Spartanburg HS	64.7	11.1	201	66.8	9.0	149
Sumter: Hillcrest MS	78.7	13.7	28	77.4	10.7	34
Union: Union County HS	51.3*	10.2	61	62.9	11.3	159
Union: Sims MS	75.5	14.7	71	73.1	10.4	64
Means (weighted) for Subsample	68.5	14.3	3497	68.8	11.8	3475
High Schools for Subsample	63.8*	11.8	2581	65.3	10.2	2596
Middle Schools for Subsample	81.6*	12.3	916	79.0	10.3	879
Alg 1 Course for Subsample	70.9	14.5	2985	70.3	11.8	2844
Int Alg Course for Subsample	59.4*	9.4	379	62.3	9.1	570

DNA2018 to **DNA**2017

Mean scores, standard deviations, and numbers tested for school districts that did not have access to Algebra Nation material during the 2017-2018 school year are included **Table 7** with results from that year and the prior year. A mean for the 18 districts is provided at the bottom of the table. (* indicates a statistically significant difference from the prior year.)

Table 7: Statistics for Districts with No Access to Algebra Nation

Districts with No Access to Algebra Nation (DNA)	2017-2018 EOCEP Algebra 1 Results			2016-2017 EOCEP Algebra 1 Results		
	Mean	SD	N	Mean	SD	N
Anderson 3	72.1	15.0	163	72.7	12.5	235
Anderson 4	73.1	14.5	256	72.6	13.5	278
Anderson 5	69.3	15.4	1053	70.2	14.4	1056
Bamberg 2	61.7	15.3	50	60.8	10.2	49
Clarendon 1	61.2*	10.0	50	65.3	7.5	64
Clarendon 2	64.0*	15.2	166	67.8	13.6	215
Edgefield	67.6*	15.0	246	71.3	12.4	242
Florence 4	56.5*	9.6	36	62.6	8.0	45
Florence 5	70.2	11.8	69	70.5	11.1	112
Greenwood 52	69.1	12.5	115	66.5	12.3	153
Horry	**73.0***	14.8	3691	71.7	13.7	3931
Jasper	55.4	10.3	149	55.8	7.7	142
Kershaw	66.3	12.9	788	66.8	11.3	874
Lancaster	68.4	14.9	1081	69.0	13.0	1144
Marlboro	**63.6***	13.2	245	60.3	9.8	312
Spartanburg 2	70.6	14.9	796	70.0	12.8	915
York 3	68.2*	13.4	1556	69.3	12.9	1532
York 4	79.4*	13.7	1317	81.5	11.9	1163
Mean (weighted) for All DNA	70.9	14.3	11827	70.8	12.9	12462

DA2018 to **DNA**2018

To examine differences between districts with and without access to Algebra Nation for the 2017-2018 school year and the prior year, **Table 8** includes the mean scores and other statistics for each. (* indicates a statistically significant higher mean for the DNA and the state mean for the respective year.)

Table 8: Comparison Statistics for Districts with and without Access to Algebra Nation

	2017-2018 EOCEP Algebra 1 Results			2016-2017 EOCEP Algebra 1 Results		
	Mean	SD	N	Mean	SD	N
Districts with Access to Algebra Nation (DA)	**67.9**	**14.2**	**46343**	**69.2**	**12.7**	**48001**
Districts without Access to Algebra Nation (DNA)	**70.9***	**14.3**	**11827**	**70.8***	**12.9**	**12462**
State Mean	**68.4**	**14.9**	**60489**	**69.4**	**13.4**	**62655**

TUF2018 to **DNA**2018 and *Subsample***TUF**2018 to **DNA**2018

To examine differences between classes taught by teachers who used Algebra Nation with fidelity to districts without access to Algebra Nation over the past two school years, **Table 9** includes the mean scores and other statistics for each. (* indicates a statistically significant higher mean of the DNA group compared to the TUF group and the TUF subsample as well as the state mean for the respective year.)

Table 9: Comparison Statistics for Use with Fidelity Samples and Districts with No Access

	2017-2018 EOCEP Algebra 1 Results			2016-2017 EOCEP Algebra 1 Results		
	Mean	SD	N	Mean	SD	N
Districts Using Algebra Nation with Fidelity (TUF)	**67.0**	**14.0**	**5590**	**67.0**	**11.1**	**8666**
Subsample of **TUF group**	**68.5**	**14.3**	**3497**	**68.8**	**11.8**	**3475**
Districts with No Access to Algebra Nation (DNA)	**70.9***	**14.3**	**11827**	**70.8***	**12.9**	**12462**
State Mean	**68.4**	**14.9**	**60489**	**69.4**	**13.4**	**62655**

Table 10 and **Table 11** that follow provide the means from the 2017-2018 EOCEP Algebra 1 examination for particular student groups taught by teachers using Algebra Nation with fidelity (TUF). The groups are based on gender (male or female), whether or not students were identified and English Language proficient (LEP or non-LEP), and culture or race (Asian, Hispanic, American Indian/Native American, Black/African-American, Pacific Islander/Native Hawaiian, White, Multi-Racial). Total number of students in the subgroups are include in parentheses under the group label at the top of the tables, and statewide means for the respective groups are provided at the bottom of the tables. Blanks indicate that no students in the subgroup were tested at school.

Table 10: Means for Gender and English Language Student Groups with TUF Sample

Teachers Using Algebra Nation with Fidelity (TUF)	2017-2018 EOCEP Algebra 1 Results			
	Gender		English Language	
	Male (2874)	Female (2700)	LEP (444)	Non-LEP (5033)
Aiken: Midland Valley HS	57.7	56.8	55.9	57.4
Anderson 2: Belton MS	78.0	73.8		74.8
Barnwell 19: Blackville-Hilda HS	62.2	67.7		64.4
Beaufort: HE McCracken MS	92.6	93.5	85.0	93.8
Beaufort: Hilton Head HS	66.2	69.8	65.5	69.9
Charleston: RB Stall HS	61.9	62.1	60.6	62.6
Cherokee: Blacksburg HS	58.3	59.2		58.6
Chesterfield: Cheraw HS	66.1	65.6	76.3	65.6
Chesterfield: McBee HS	61.6	60.5		61.1
Colleton: Colleton County MS	72.7	78.1	67.0	75.7
Dillon 4: Dillon High School	60.1	61.9	64.0	61.1

Dillon 4: Lakeview High School	64.7	67.3	52.0	65.9
Dorchester 2: Ashley Ridge HS	67.0	68.0	57.9	67.6
Dorchester 2: Ft Dorchester HS	66.3	68.4	63.3	67.5
Dorchester 2: Summerville HS	65.0	64.8	57.7	65.1
Dorchester 2: Gregg MS	85.9	93.3		84.8
Florence 1: West Florence HS	63.0	63.8	65.0	63.2
Florence 1: Southside MS	85.0	81.2		82.6
Florence 3: RE McNair Jr HS	67.1	77.6	81.0	74.5
Greenville: Berea HS	58.4	60.2	58.1	59.5
Greenwood 50: Greenwood HS	61.5	62.8	58.6	62.4
Greenwood 50: Brewer MS	79.9	85.0	81.0	83.3
Greenwood 50: Westview MS	82.3	79.6	79.0	81.5
Laurens 56: Clinton HS	57.4	62.1	70.0	59.0
Lexington 3: Batesburg-Lee MS	71.1	76.4		73.6
Lexington 5: Dutch Fork HS	64.3	68.9	62.0	66.3
Lexington 5: Chapin MS	84.8	86.3	73.0	85.6
Lexington 5: Dutch Fork MS	87.4	84.4		86.0
Lexington 5: Irmo MS	78.7	79.3	54.5	79.5
Newberry: Mid Carolina HS	62.9	64.9	55.9	65.7
Oconee: Seneca HS	58.2	57.7	65.5	58.0
Orangeburg 3: Lake Marion HS	61.8	60.7	65.0	61.2
Pickens: Pickens HS	61.5	62.0	65.3	61.7
Richland 1: AC Flora HS	58.7	60.9	51.0	61.0
Richland 1: Eau Claire HS	55.3	58.8		57.5
Richland 1: St Andrews MS	71.0	70.0		70.3
Richland 2: Blythewood HS	66.9	61.1		63.8
Richland 2: Richland NE HS	64.5	64.3	63.8	65.1
Richland 2: EL Wright MS	95.8	93.6	85.0	95.5
Spartanburg 6: Dorman HS	57.1	57.7	57.7	57.2
Spartanburg 6: Dorman Fresh C	68.6	63.6	67.2	68.4
Spartanburg 7: Spartanburg HS	63.7	65.7	64.3	64.7
Sumter: Hillcrest MS	75.7	80.6		78.7
Union: Union County HS	53.6	53.6	49.0	53.7
Union: Sims MS	76.0	75.2		75.5
Mean (weighted) for TUF	**66.2**	**67.9**	**61.7**	**67.5**
Statewide Means	**67.3**	**69.7**	**65.8**	**68.6**

Table 11: Means for Culture/Race Student Groups with TUF Sample

Teachers Using Algebra Nation with Fidelity (TUF)	2017-2018 EOCEP Algebra 1 Results						
	Culture/Race						
	Asian (80)	Hispanic (652)	AI/AN (22)	Black (2084)	NH/PI (10)	White (2510)	Multi-Race (190)
Aiken: Midland Valley HS	63.0	56.3	65.0	54.9		58.5	61.0
Anderson 2: Belton MS		77.0		67.5		75.4	70.0
Barnwell 19: Blackville-Hilda HS				64.9		66.8	
Beaufort: HE McCracken MS	96.3	90.7				93.9	86.5
Beaufort: Hilton Head HS	81.5	65.5		60.3		72.0	78.5
Charleston: RB Stall HS	68.0	61.3		61.1		68.8	59.0
Cherokee: Blacksburg HS				57.8		58.4	
Chesterfield: Cheraw HS	81.0	76.3		62.2		68.7	67.0
Chesterfield: McBee HS		46.5	48.0	58.2		62.0	66.3
Colleton: Colleton County MS	74.5	73.3		72.8		78.0	73.5
Dillon 4: Dillon High School		63.3	63.0	61.3		59.1	64.0
Dillon 4: Lakeview High School		50.5	69.8	64.7		66.8	66.1
Dorchester 2: Ashley Ridge HS	67.0	71.6		63.6	61.0	69.7	65.6
Dorchester 2: Ft Dorchester HS	74.9	66.4	67.0	63.6	76.0	70.6	71.9
Dorchester 2: Summerville HS	73.0	63.6	59.8	61.6	54.0	67.4	63.5
Dorchester 2: Gregg MS	87.0	81.2		84.6		85.1	83.5
Florence 1: West Florence HS	77.7	65.0		59.8		67.2	58.3
Florence 1: Southside MS		85.5		77.9		83.8	83.5
Florence 3: RE McNair Jr HS		74.0		68.7		85.6	80.5
Greenville: Berea HS		59.0	52.5	56.8		62.2	61.3
Greenwood 50: Greenwood HS	69.5	61.2		59.7		65.5	
Greenwood 50: Brewer MS	87.7	85.0	74.0	85.6		83.3	79.5
Greenwood 50: Westview MS	79.0	72.0		77.6		82.6	75.3
Laurens 56: Clinton HS		66.7		58.2		60.2	56.8
Lexington 3: Batesburg-Lees MS		79.0		67.0	72.0	74.3	73.5
Lexington 5: Dutch Fork HS	77.0	65.3		65.3	72.0	66.5	63.0
Lexington 5: Chapin MS	86.3	86.1		75.8		85.9	87.0
Lexington 5: Dutch Fork MS		87.0		94.0		85.3	82.5
Lexington 5: Irmo MS	70.5	70.8		79.5	89.0	80.7	67.7
Newberry: Mid Carolina HS		59.7		62.4		67.6	45.0
Oconee: Seneca HS	60.0	57.7		55.6		59.2	59.3
Pickens: Pickens HS		60.5		53.0		62.0	64.7
Richland 1: AC Flora HS	51.3	52.3		58.9		65.3	63.0
Richland 1: Eau Claire HS		59.0		57.1			81.0

Richland 1: St Andrews MS		77.0		69.9		67.0	73.0
Richland 2: Blythewood HS				59.8		68.6	89.0
Richland 2: Richland NE HS	74.7	64.5	55.0	62.5	65.0	75.4	73.4
Richland 2: EL Wright MS	92.5	92.5		91.5		97.4	
Spartanburg 6: Dorman HS	55.0	58.6		57.4		56.7	59.0
Spartanburg 6: Dorman Fresh C	79.6	69.1	78.7	62.5		72.2	62.5
Spartanburg 7: Spartanburg HS	78.4	58.8		61.4		71.6	65.0
Sumter: Hillcrest MS	79.0	63.0	51.0	80.5		78.6	87.7
Union: Union County HS		49.0	45.0	53.0		53.9	66.0
Union: Sims MS	96.0	73.0		68.1		78.4	73.3
Mean (weighted) for TUF	**77.1**	**64.5**	**66.5**	**62.1**	**66.4**	**71.4**	**68.4**
State Means	**81.7**	**66.4**	**65.8**	**61.6**	**68.6**	**72.6**	**68.8**

- **Gender**: Male and Female
- **English Language**: Limited English Proficient (LEP) Level 1-4, Non-LEP
- **Type of Algebra Course**: Algebra 1, Intermediate Algebra
- **School Level:** middle, high
- **Culture/Race**: Asian, Hispanic/Latino, American Indian/Alaska Native, Black/African American, Native Hawaiian/Pacific Islander, White, Two or more races

Twenty-one (21) usage variables were correlated to the means scores of students of teachers using Algebra Nation with fidelity: 12 addressing teachers' usage and 9 addressing students' usage. Correlation coefficients were calculated to estimate the relationship of each usage variables and with the per-teacher examination score means. **Table 12** and **Table 13** contain the correlation coefficient for the usage variables the probability that the correlation is not 0. (* indicates that the correlation is statistically significant.)

Table 12: Teacher Usage of Algebra Nation Correlated to EOCEP Algebra 1 Examination Scores

Teacher Usage from TUF Group of Algebra Nation Components	Correlation of Usage Variables with Per-Teacher Means from the 2017-2018 EOCEP Algebra 1 Scores	*p* Values
Total number of times the teacher logged in during the course	0.30*	0.0049
Total number of reports the teacher generated during the course	0.07	0.51
Total number of times teachers posted to students in the course	0.16	0.13
Total number of document downloads by the teacher during the course from the teacher area	0.02	0.82
Total number of downloads by the teacher from any area during the course	0.07	0.52
Total number of downloads by the teacher of independent practice materials during the course	0.02	0.85

Total number of downloads of Mini Assessments by the teacher during the course	0.04	0.71
Total number of times the teacher accessed the system teacher area during the course	0.36*	0.0007
Total number of times the teacher logged on to view Videos during the course and during school hours	0.01	0.94
Total number of times the teacher logged on to view Videos during the course and outside of school hours	0.10	0.36
Total number of times the teacher viewed videos more than once during school hours during the course.	0.00	0.97
Total number of times the teacher viewed Videos more than once outside of school hours during the course.	0.02	0.84

Table 13: Student Usage of Algebra Nation Correlated to EOCEP Algebra 1 Examination Scores

Student Usage of Algebra Nation Components	Correlation of Usage Variables with Per-Teacher Means from the 2017-2018 EOCEP Algebra 1 Scores	*p* Values
Total number of student Logins	0.09	0.39
Total number of student Video views during school hours	-0.01	0.94
Total number of student Video views outside of school hours	0.48*	< 0.0001
Total number of Test Yourself completed	0.49*	< 0.0001
Total number of student Wall Posts during school hours	0.14	0.20
Total number of student Wall Posts outside school hours	0.26*	0.016
Total number of Karma Points	0.28*	0.01
Number of students that started On Ramp but did not finish	-0.17	0.11
Number of students that completed On Ramp	0.01	0.93

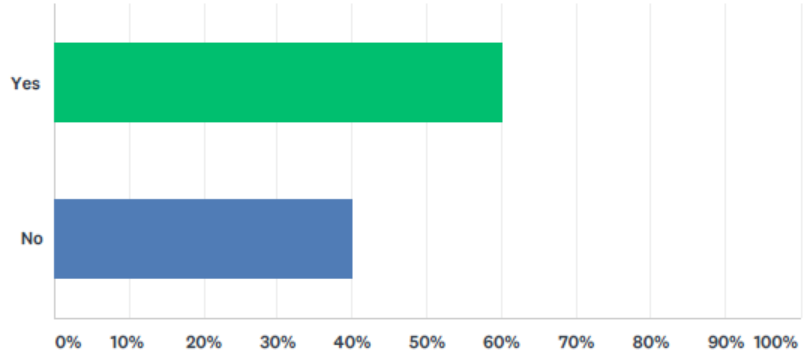
Teacher Survey

Data gathered from Questions 1 to 23 of the Algebra Nation Teacher Survey (copy provided in **Appendix A**) along with the final open-ended comments Question 31 are presented in this section. Discussion and conclusions drawn from this data with respect to the final three research questions of this evaluation study are provided in the section that follows.

The first question (**Question 1** or Q1) assessed the degree to which respondents used Algebra Nation over the school year with 60% of respondents indicating use of Algebra Nation at least once every two weeks.

Q1 Did you use Algebra Nation to teach your students at least once every two weeks?

Answered: 135 Skipped: 1



Question 2 asked for input from those who answered "No" to **Question 1** on why their usage was less frequent than once every two weeks. 64 teachers responded with explanations.

Q2 If you answered NO, why did you not or what prevented you from using Algebra Nation with your students at least once every two weeks?

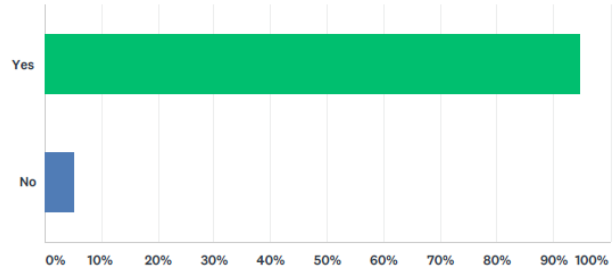
Answered: 64 Skipped: 72

About 30% (19) indicated that they found Algebra Nation **difficult to use or challenging to implement**. About 19% (12) indicated **preferring other products or curriculum** and a comparable number (11) indicated that their use was less frequent than every two weeks because they chose to use Algebra Nation to **review or to supplement instruction** at different times during the school year. About 12% (8) indicated **technology access or reliability** prevented more frequent use, and about 10% (6) indicated their school or district **curriculum sequence or pacing guide** did not allow for more use.

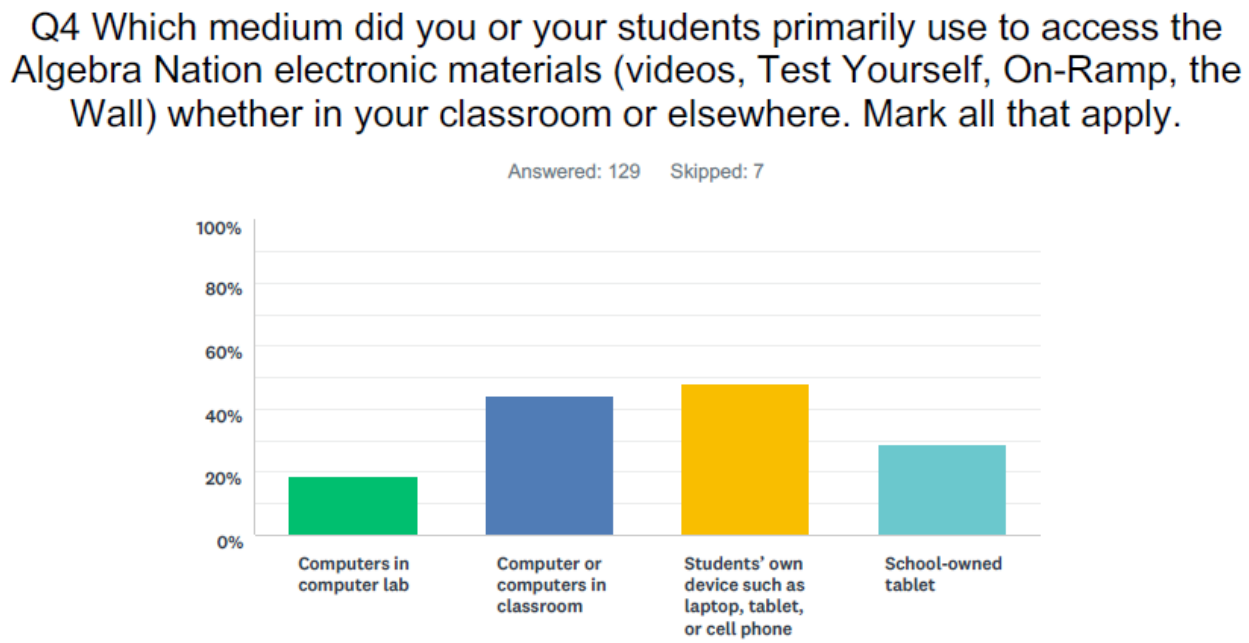
In **Question 3**, nearly all respondents indicated that their students had access to the Algebra Nation printed Workbook:

Q3 Did your students have access to the printed Algebra Nation Workbook?

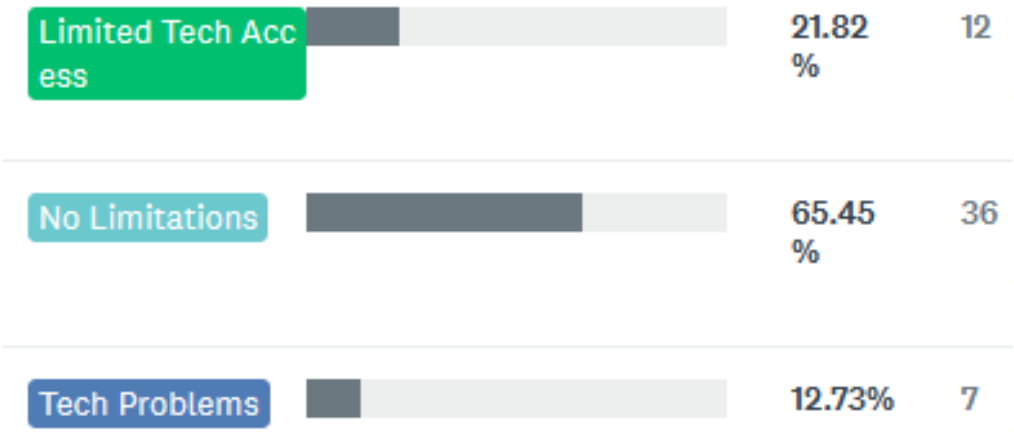
Answered: 136 Skipped: 0



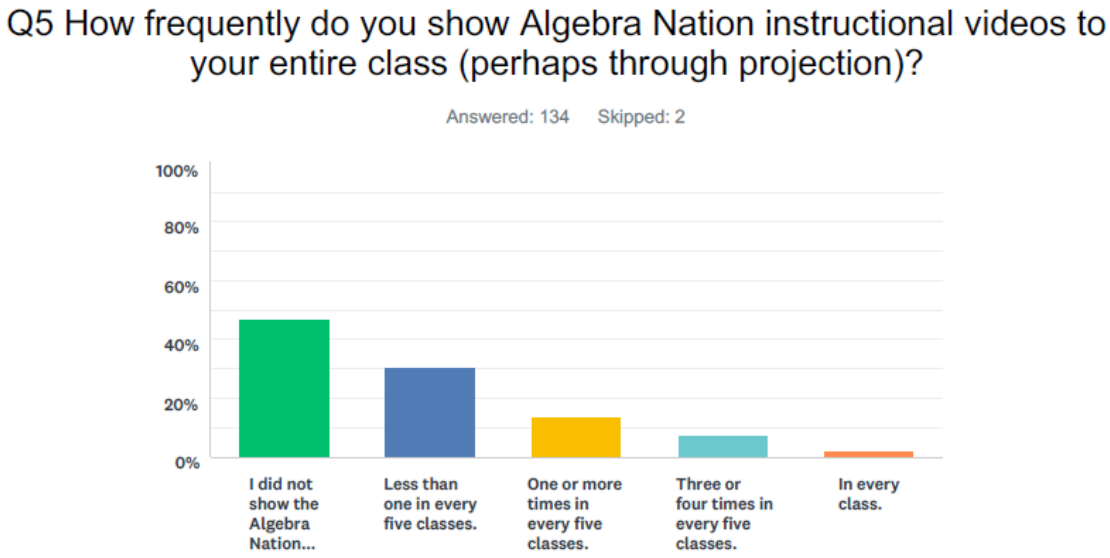
Respondents provided information on how they or their students accessed Algebra Nation through **Question 4**.



Students' own devices or classroom computers were the most widely used and nearly 30% of respondents indicated use of school owned tablets. Comments about access were made by 55 respondents and the majority (36 commenting respondents or 65% of those commenting) indicated having **no limitations. Limited access to technology at school or home** was mentioned by 12 (22%) respondents and **technical problems** such as log-in or videos not functions were mentioned by 7 (13%).

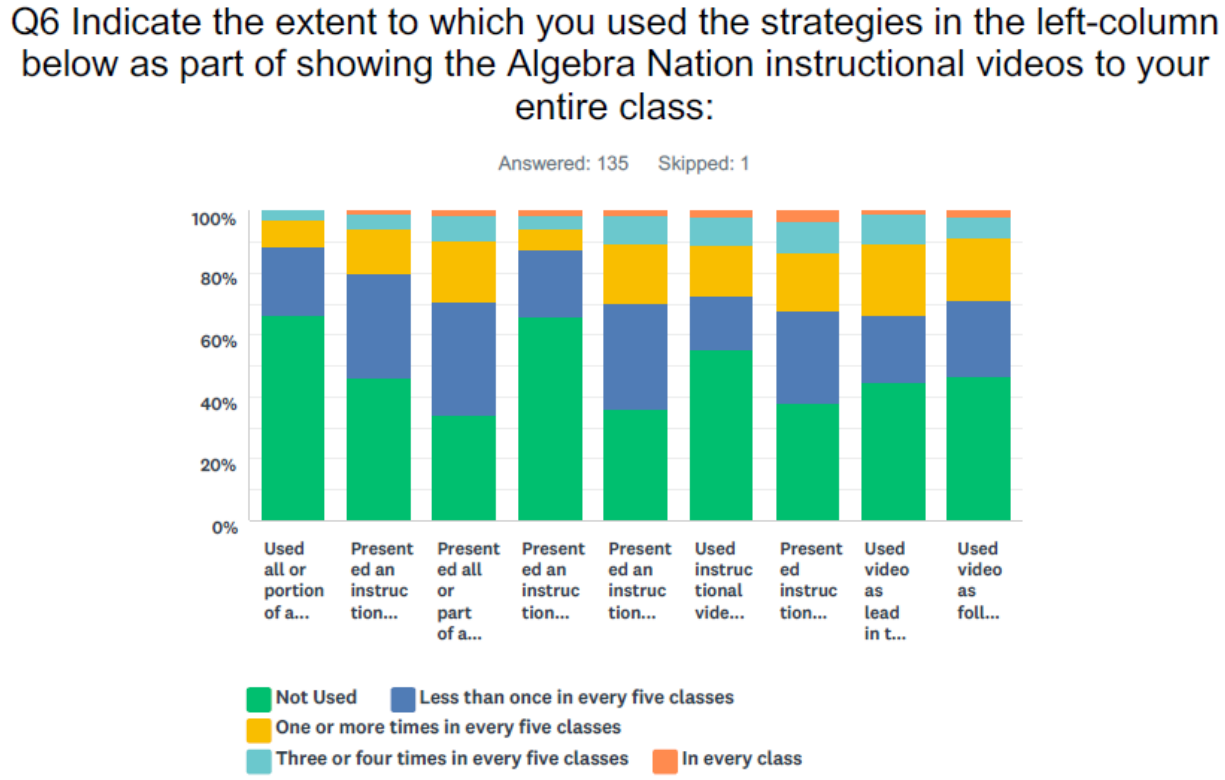


Question 5 addressed the use of the instructional videos as part of whole class instruction.



Most respondents (54%) used the videos for whole class instruction, with 23% using then one or more times in every five classes. Videos were not used as whole class instruction by 46% of respondents.

Question 6 gathered data on how teachers used the instructional videos. Most respondents (66%) indicated using all or part of a video as a lesson component, to reinforce concepts, or as an alternative teaching strategy.

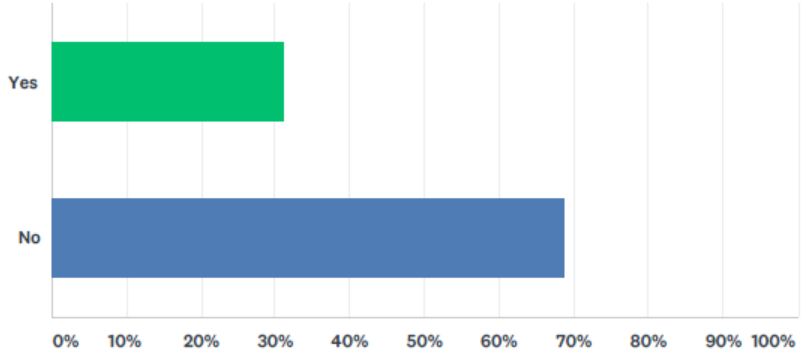


	NOT USED	LESS THAN ONCE IN EVERY FIVE CLASSES	ONE OR MORE TIMES IN EVERY FIVE CLASSES	THREE OR FOUR TIMES IN EVERY FIVE CLASSES	IN EVERY CLASS	TOTAL
Used all or portion of an instructional video as a bell ringer/warmup activity.	66.17% 88	22.56% 30	8.27% 11	3.01% 4	0.00% 0	133
Presented an instructional video prior to my own lesson instruction.	45.86% 61	33.83% 45	14.29% 19	5.26% 7	0.75% 1	133
Presented all or part of an instructional video as a component of a lesson I taught.	33.83% 45	36.84% 49	19.55% 26	8.27% 11	1.50% 2	133
Presented an instructional video followed by a quiz.	65.67% 88	21.64% 29	6.72% 9	4.48% 6	1.49% 2	134
Presented an instructional video after teaching a lesson to reinforce concepts.	35.82% 48	34.33% 46	19.40% 26	8.96% 12	1.49% 2	134
Used instructional videos for test review.	54.81% 74	17.78% 24	16.30% 22	8.89% 12	2.22% 3	135
Presented instructional video as alternative or 2nd teaching method.	37.78% 51	29.63% 40	19.26% 26	9.63% 13	3.70% 5	135
Used video as lead in to workbook practice problems.	44.36% 59	21.80% 29	23.31% 31	9.77% 13	0.75% 1	133
Used video as follow-up to workbook practice problems.	46.27% 62	24.63% 33	20.15% 27	6.72% 9	2.24% 3	134

Most respondents (69%) did not establish a learning center for students to use Algebra Nation materials but this strategy was used by 42 (or 31%) of respondents as reported on **Question 7**.

Q7 Have you established a learning center within your classroom where one or more students were required to work on Algebra Nation materials?

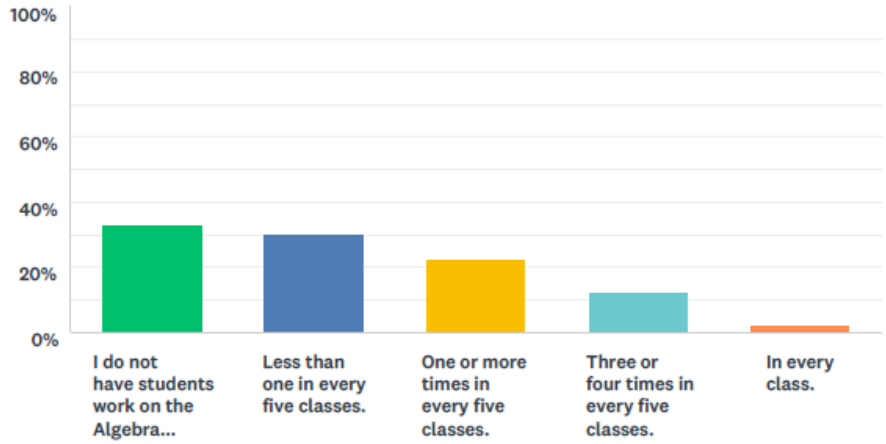
Answered: 135 Skipped: 1



Question 8 provided evidence that the majority (67%) of respondents allowed students access to the Algebra Nation website or app during class time with 20% doing so in every class or at least 3 times in every 5 classes.

Q8 How frequently do you have a student or student groups (2-6 students) work individually on the Algebra Nation website or tablet app during class time?

Answered: 134 Skipped: 2



Question 9 followed up on the usage to determine what Algebra Nation features were used. The Workbook was used most extensively (one or more times every 5 classes) by 50% of respondents followed by the use of the instructional videos by 39% and the Test Yourself practice tool by 35%. The On Ramp Study Guide was used one or more times in every 5 classes by 26% and the Algebra Wall used the least (by 10%).

Q9 Indicate how frequently you have a student or student groups worked individually on the following Algebra Nation materials during class time.

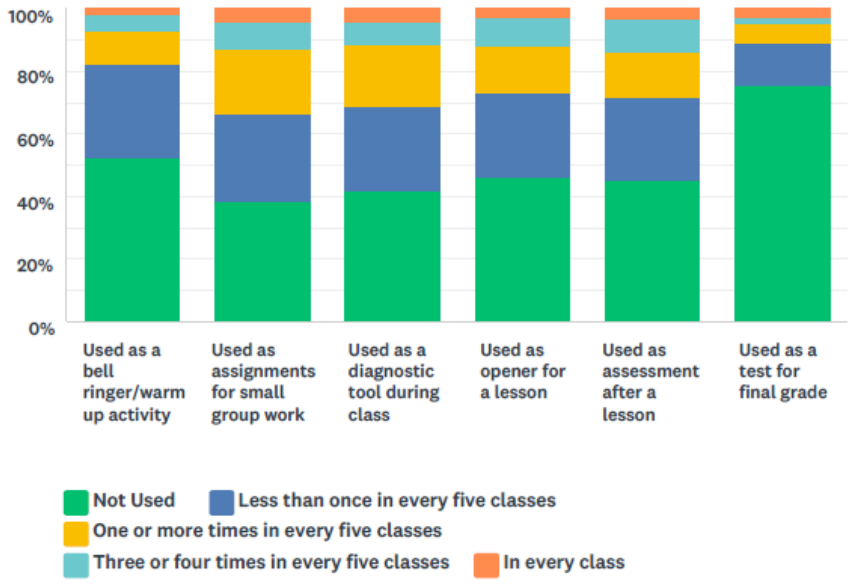
Answered: 135 Skipped: 1

	NOT USED	LESS THAN ONCE IN EVERY FIVE CLASSES	ONE OR MORE TIMES IN EVERY FIVE CLASSES	THREE OR FOUR TIMES IN EVERY FIVE CLASSES	IN EVERY CLASS	TOTAL
Watched instructional videos	26.12% 35	35.07% 47	24.63% 33	10.45% 14	3.73% 5	134
Used the Test Yourself practice tool	26.32% 35	39.10% 52	22.56% 30	9.77% 13	2.26% 3	133
Used the On Ramp Study Guide	36.57% 49	37.31% 50	17.16% 23	5.22% 7	3.73% 5	134
Posted to the Algebra Wall	64.93% 87	24.63% 33	5.22% 7	3.73% 5	1.49% 2	134
Used the provided Workbook	23.13% 31	26.87% 36	26.87% 36	15.67% 21	7.46% 10	134

To gather data on how the popular **Workbook** was used, **Question 10** provided examples from which the respondents selected uses. Using the Workbook as part of "small group work" was the most popular strategy (34%) followed closely by using it as a "diagnostic tool during class" (32%). The Workbook was also widely and often used as an assessment tool after a lesson or as a lesson opener (28% and 27%, respectively). Use as a "bell ringer/warm up activity" or as a test to assign final grades was less popular, with 52% and 75%, respectively not using the Workbook for these purposes.

Q10 Indicate the extent to which you used the strategies in the left-column below as part of instruction with Algebra Nation printed Workbook practice problems:

Answered: 134 Skipped: 2



	NOT USED	LESS THAN ONCE IN EVERY FIVE CLASSES	ONE OR MORE TIMES IN EVERY FIVE CLASSES	THREE OR FOUR TIMES IN EVERY FIVE CLASSES	IN EVERY CLASS	TOTAL
Used as a bell ringer/warmup activity	52.24% 70	29.85% 40	10.45% 14	5.22% 7	2.24% 3	134
Used as assignments for small group work	38.35% 51	27.82% 37	21.05% 28	8.27% 11	4.51% 6	133
Used as a diagnostic tool during class	41.35% 55	27.07% 36	20.30% 27	6.77% 9	4.51% 6	133
Used as opener for a lesson	45.86% 61	27.07% 36	15.04% 20	9.02% 12	3.01% 4	133
Used as assessment after a lesson	44.78% 60	26.87% 36	14.18% 19	10.45% 14	3.73% 5	134
Used as a test for final grade	75.37% 101	13.43% 18	5.97% 8	2.24% 3	2.99% 4	134

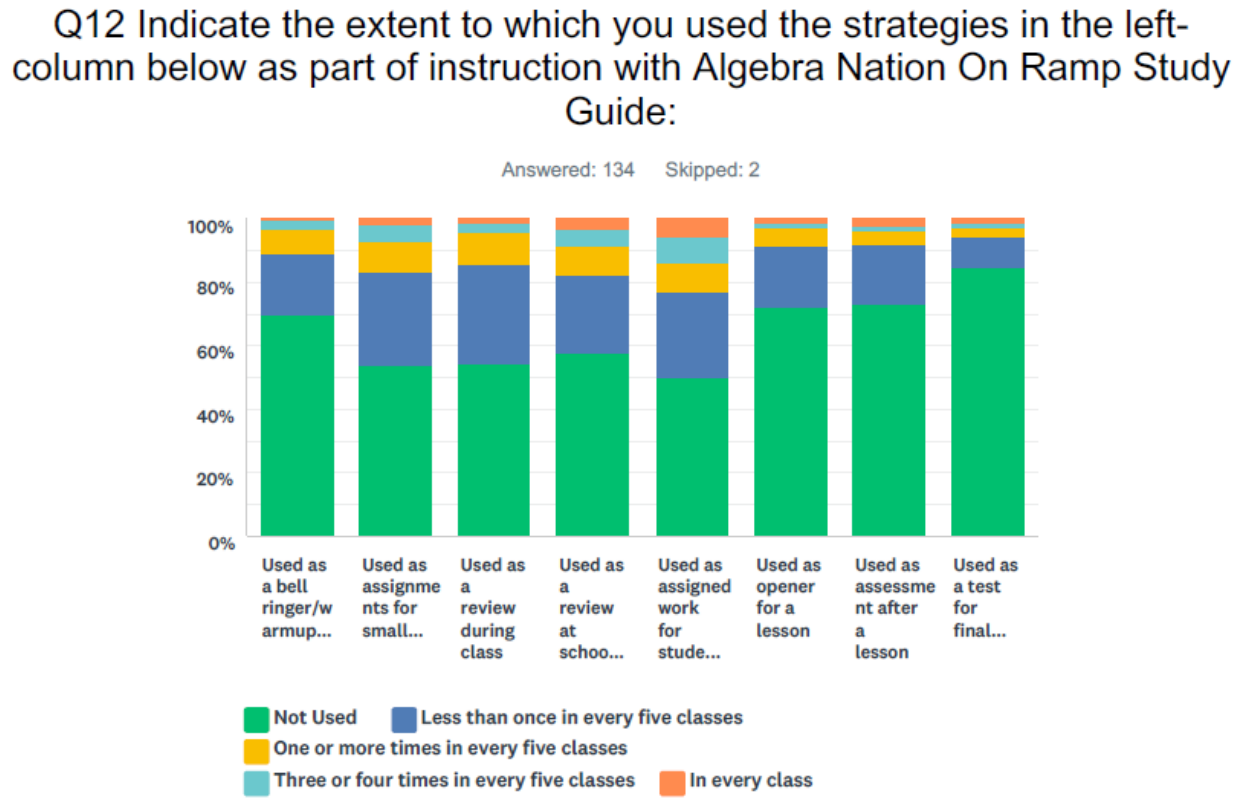
Similar to Question 10, **Question 11** addressed how respondents used the **Test Yourself Practice Tool**. The usage pattern is comparable to how the Workbook was used with small group and diagnostic work the most popular uses. 55% of respondents indicated using Test Yourself for diagnostic purposes even if in less than 1 in every 5 classes.

Q11 Indicate the extent to which you used the strategies in the left-column below as part of instruction with Algebra Nation Test Yourself Practice Tool:

Answered: 134 Skipped: 2

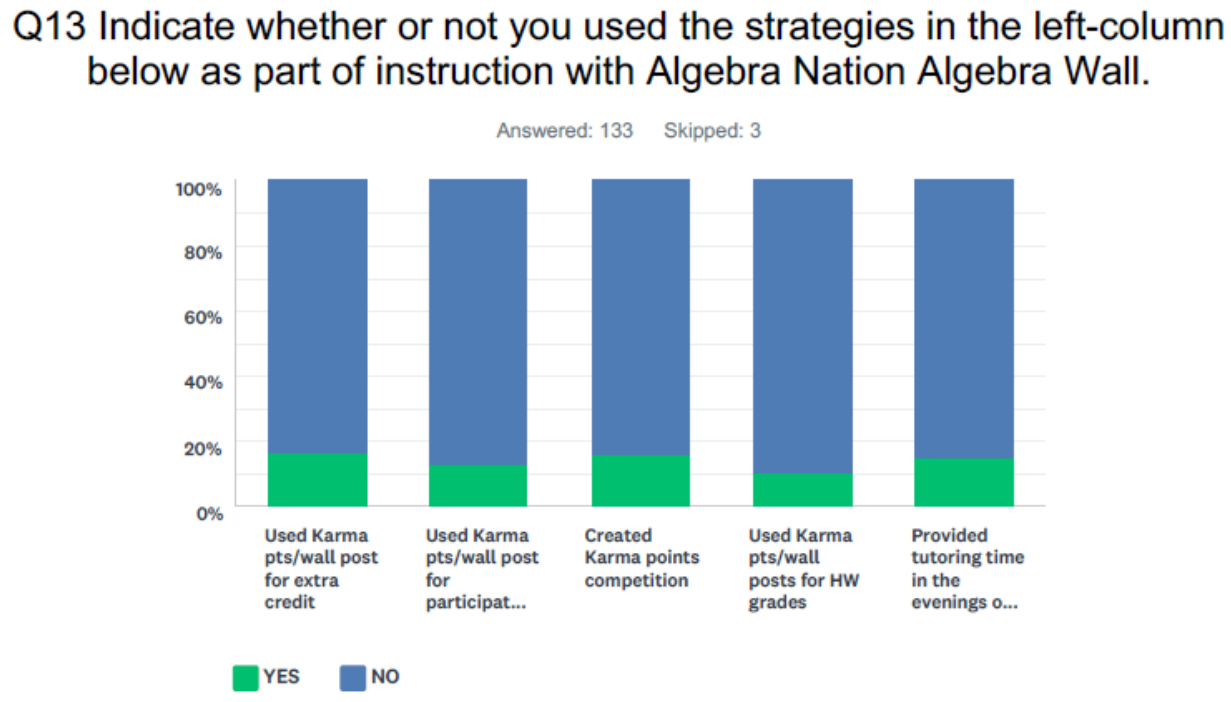
	NOT USED	LESS THAN ONCE IN EVERY FIVE CLASSES	ONE OR MORE TIMES IN EVERY FIVE CLASSES	THREE OR FOUR TIMES IN EVERY FIVE CLASSES	IN EVERY CLASS	TOTAL
Used as a bell ringer/warmup activity	60.15% 80	26.32% 35	6.77% 9	4.51% 6	2.26% 3	133
Used as assignments for small group work	50.00% 67	26.87% 36	15.67% 21	5.97% 8	1.49% 2	134
Used as a diagnostic tool during class	44.78% 60	32.84% 44	14.18% 19	6.72% 9	1.49% 2	134
Used as opener for a lesson	63.43% 85	21.64% 29	8.21% 11	5.22% 7	1.49% 2	134
Used as assessment after a lesson	48.51% 65	27.61% 37	13.43% 18	8.96% 12	1.49% 2	134
Used as a test for final grade	73.13% 98	13.43% 18	7.46% 10	5.22% 7	0.75% 1	134

The **On Ramp Study Guide** was not as widely used as the Workbook, videos, or Test Yourself Tool, with fewer than 50% of respondents using it all as documented by responses to **Question 12**. Those who used this tool did so for "assigned work … at home," as "review during class," or as "assignments for small groups."



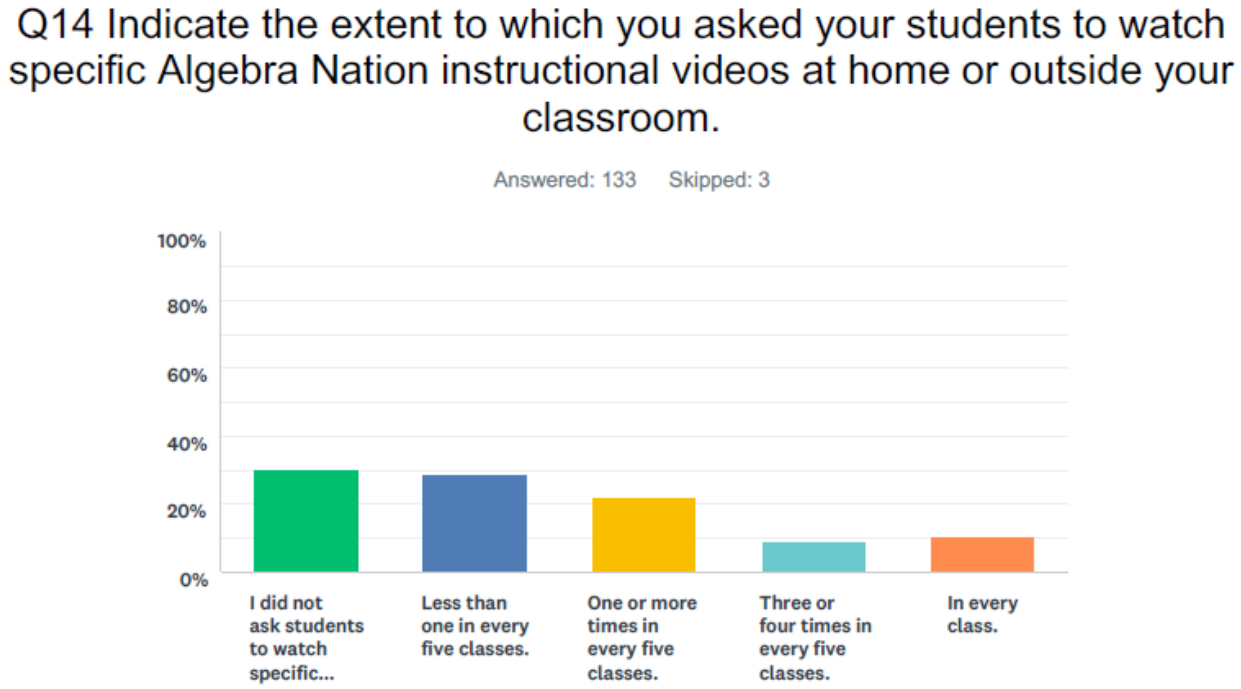
	NOT USED	LESS THAN ONCE IN EVERY FIVE CLASSES	ONE OR MORE TIMES IN EVERY FIVE CLASSES	THREE OR FOUR TIMES IN EVERY FIVE CLASSES	IN EVERY CLASS	TOTAL
Used as a bell ringer/warmup activity	69.40% 93	19.40% 26	7.46% 10	2.99% 4	0.75% 1	134
Used as assignments for small group work	53.73% 72	29.10% 39	9.70% 13	5.22% 7	2.24% 3	134
Used as a review during class	54.14% 72	31.58% 42	9.77% 13	3.01% 4	1.50% 2	133
Used as a review at school but outside of class	57.46% 77	24.63% 33	8.96% 12	5.22% 7	3.73% 5	134
Used as assigned work for student at home	50.00% 67	26.87% 36	8.96% 12	8.21% 11	5.97% 8	134
Used as opener for a lesson	72.18% 96	18.80% 25	6.02% 8	1.50% 2	1.50% 2	133
Used as assessment after a lesson	72.93% 97	18.80% 25	4.51% 6	1.50% 2	2.26% 3	133
Used as a test for final grade	84.50% 109	9.30% 12	3.10% 4	1.55% 2	1.55% 2	129

Question 13 asked respondents whether or not they included incentives for having students use the **Algebra Wall**. Most respondents did not use the Algebra Wall, but between 10% and 17% did so using incentives like extra credit, competition points, or evening tutoring.



	YES	NO	TOTAL
Used Karma pts/wall post for extra credit	16.54% 22	83.46% 111	133
Used Karma pts/wall post for participation pts	12.78% 17	87.22% 116	133
Created Karma points competition	15.79% 21	84.21% 112	133
Used Karma pts/wall posts for HW grades	9.77% 13	90.23% 120	133
Provided tutoring time in the evenings on the Algebra Wall	15.15% 20	84.85% 112	132

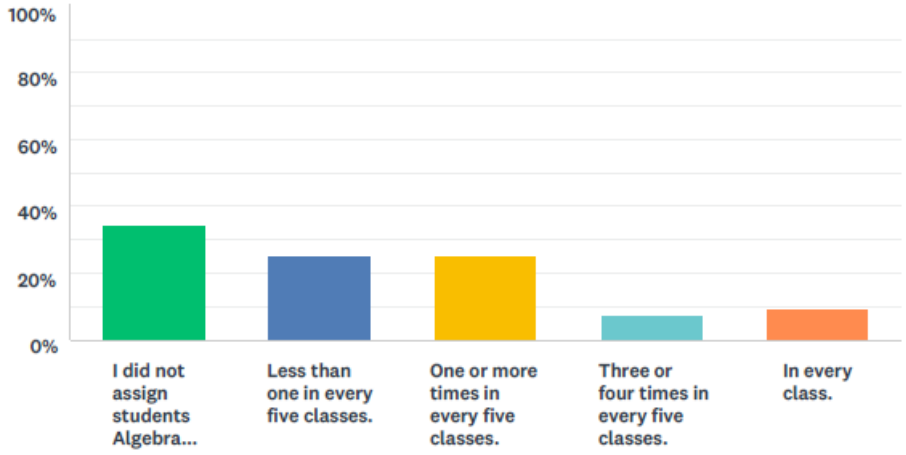
Regarding the use of the **instructional videos at home or outside of the classroom**, 70% of respondents indicated in response to **Question 14** that they asked or expected their students to view videos outside of class. 11% had this expectation every school day and over 30% for 1 to 4 of every 5 classes.



Similarly for the **Workbook** addressed in **Question 15**, 66% of respondents expected their students to use this resource as part of homework, and 10% required its use as homework in every class with 32% using it between 1 and 4 of every 5 classes. The **Test Yourself** tool was not used as much as the **Workbook** but 53% of respondents indicated in **Question 16** that they used it some, with 33% using it at least once in every five classes.

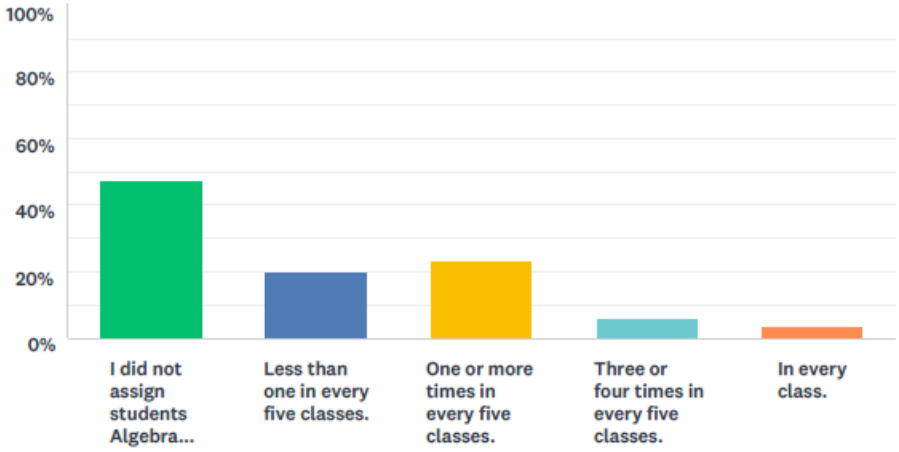
Q15 Indicate the extent to which you assigned your students Algebra Nation printed Workbook practice problems as homework.

Answered: 133 Skipped: 3



Q16 Indicate the extent to which you assigned your students Algebra Nation printed Test Yourself tool as homework.

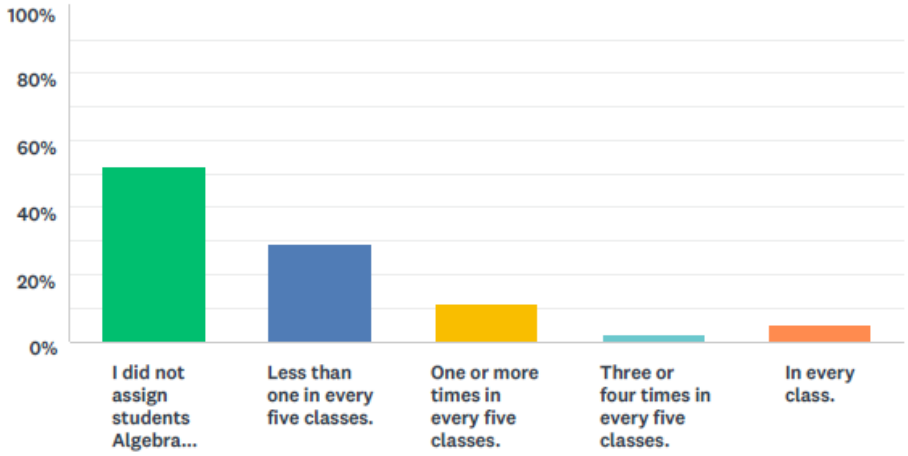
Answered: 134 Skipped: 2



Lastly the **On Ramp Study Guide** was assigned as homework by 47% of respondents and when used, typically used less than once in every five classes as indicated by responses to **Question 17**.

Q17 Indicate the extent to which you assigned your students Algebra Nation On Ramp Study Guide as homework.

Answered: 134 Skipped: 2



To gather data on how Algebra Nation was used for remediation with students who might be struggling or falling behind in algebra, **Question 18** provided nine examples of instructional techniques respondents might have used and the option of indicating non-use. 74% of respondents did use Algebra Nation for remediation. The **Workbook** for practice (47%) and the **instructional videos** assigned to particular students to watch at school (44%) were the most widely used techniques.

Q18 Indicate the extent to which used Algebra Nation as a remediation tool with your students who might have struggled or were falling behind. Mark all that apply.

Answered: 133 Skipped: 3

ANSWER CHOICES	RESPONSES	
I did not use Algebra Nation as a remediation tool.	26.32%	35
I assigned specific Algebra Nation instructional video to particular students as homework.	31.58%	42
I assigned specific Algebra Nation Workbook practice to particular students as homework.	35.34%	47
I assigned specific Algebra Nation On Ramp videos to particular students as homework.	17.29%	23
I assigned specific Algebra Nation On Ramp Study Guides to particular students as homework.	15.79%	21
I assigned specific Algebra Nation instructional video to particular students to watch at school.	44.36%	59
I assigned specific Algebra Nation Workbook practice to particular students to use at school.	46.62%	62
I assigned specific Algebra Nation On Ramp videos to particular students to watch at school.	27.07%	36
I assigned specific Algebra Nation On Ramp Study Guides to particular students to use at school.	18.80%	25
I provided before or after school assistance for students using Algebra Nation resources.	31.58%	42
Total Respondents: 133		

Question 19 provided space for respondents to indicate what each perceived to be the "**main strength of Algebra Nation**." 88% of respondents provided examples and comments. By far (41% or 49 responses) respondents cited the **varied instruction** included as part of the videos and as a supplement to their own teaching as the main strength. Respondents (17% or 20) also cited the **videos**. Sample comments included:

- "The variety of approaches with the different experts and the rigor of the questions. "
- " Student Choice. Students were invested, because they were allowed to choose the Algebra Expert. They also enjoyed having the workbook in front of them. My students were fully invested in the program."
- "The main strength of Algebra Nation is that Students get to decide who they want to be their study tutor to cater to their learning needs. Also that students can use the tool at home to get help with things they did not understand in class and reach out to other students like them."
- "Spanish Teacher … Time for students to learn/have exposure to material I don't have time for in class. Work ahead of the lesson."
- "The instructional videos and how they were taught in different levels."

Other strengths mentioned were the **high expectations** for students found in the materials and the ability to use the materials for **practice and skill building**, each cited by 13% or 16 respondents. Sample comments included:

- "Critical Thinking Problems made easy to understand through one on one approach/pacing with students"
- "Harder questions made them think."
- "Deep thought questions. Asks questions in ways they have to think. Great preparation for EOC"
- "I've found Algebra Nation to be a great remediation tool. Students being able to get help (through videos with a variety of tutors or the Algebra Wall) outside of class is the biggest benefit I've seen."
- "Review in a nonthreatening way. Algebra Nation tutorials allow the student multiple reviews without drawing attention to their progress in learning a concept."

The **Workbook** was also cited by 11% or 13 respondents as a main strength. A sample comment was "Having the online resources and the printed copy made for better integration of lessons into my personal lessons. The workbook and site were easy to navigate and use."

For **Question 20**, respondents were asked to describe the "**most significant limitation of Algebra Nation**." 86% of respondents provided examples and comments. "**No limitation**" was cited by 22 or 19% of respondents. The most cited limitation was a **difficulty or challenge to use** the resource by 22 or 19% of respondents. Sample comments included:

- "Not knowing how I could utilize everything AN offered."
- "I found that I did not have time to familiarize myself with the components of Algebra Nation during my planning time therefore did not use it."
- "Some of the videos were rather lengthy for certain topics. It is difficult to get a busy high school student to take 30-40 minutes out of their schedule to watch a video. If there was a "mini lesson" section were topics were covered briefly (less than 5 minutes) this would be beneficial. More of a reminder and less of a lesson."

Also commonly cited were challenges tied to technology access, but these were typically a limitation of the school or district. However, the **lack of available technology** limited teachers' ability to use the resources. 21 or 19% of respondents cited technology access as a limitation Sample comments included:

- "Lack of technology in school and community"
- "Students were not willing to do at home and some did not have access to the internet."
- "had to sign up for the computer cart (which could be hard as many teachers need the cart)."
- "not all of our students have devices and we are not one to one"

Related to challenges of implementation, 13 or 11% of respondents commented on the difference between **how school or district curriculum is sequenced** differing from how the topics were sequenced in Algebra Nation as a limitation. Sample comments included:

- "The curriculum did not match my pacing guide. I would have to look for where my current content was."
- "The units in Algebra Nation did not correlate well with the units I teach. This made it difficult to utilize the test yourself feature and other features of the program. If I know we will have Algebra Nation next year - then I plan to readjust my units so they correlate better with the program."

Lastly, 12 or 10% of respondents commented that **more student practice resources** are needed and not having more was a limitation. Sample comments included:

- "The limitation would be the lack of practice problems within the workbook. At least three to five more problems per topic would give the students more practice on each topic. A quiz included midway through each section would be a great checkpoint."
- "I wish some of the lessons had a little more practice and additional examples on the assessments and worksheets. But that is just because I really liked the ones provided - i just wanted more! :)"

To assess respondents' perception of the impact of Algebra Nation on students, five yes/no statements were included as part of **Question 21**. Over 95% of responding teachers indicated that Algebra Nation was "**appropriately aligned to the South Carolina Algebra 1 standards**" and that the materials were "**rigorous and appropriately challenging.**" 80% of responding teachers indicated that Algebra Nation use "**positively impacted … students' learning**" in the algebra course they taught. Slightly fewer (67%) felt Algebra Nation "**positively impacted… students' EOCEP Algebra 1 test scores**" and 61% felt they had actually "**found evidence that Algebra Nation [had] a positive impact on test scores, grades, or confidence levels**."

	YES	NO	TOTAL
Appropriately aligned to the South Carolina Algebra 1 standards	96.15% 125	3.85% 5	130
Algebra Nation materials are rigorous and appropriately challenging	95.35% 123	4.65% 6	129
Positively impacted my students' EOCEP Algebra 1 test scores	66.98% 71	33.02% 35	106
Positively impacted my students learning in the algebra course I taught	79.67% 98	20.33% 25	123
I found evidence that Algebra Nation has a positive impact on test scores, grades, or confidence levels	61.06% 69	38.94% 44	113

Comments as part of **Question 21** were provided by 54 or 42% of the respondents. Most (31 or 57%) cited student factors influencing their perceptions of impact. Sample comments included:

- “My students were able to begin feeling more comfortable with the material being presented to them in a variety of ways. They were able to practice the concepts they learned in class and apply them on a computer, which is exactly what the EOC will do.”
- “Students who used Algebra Nation have told me it has helped them better understand concepts.”
- “I feel Algebra Nation has helped my students in persevering through more rigorous problems and application type examples. They won't settle for just making a 70%-- they continue to work towards 100% and are quick to watch solution videos at the end of the Test Yourself! Questions to understand why they missed a specific question. “
- “I have seen students gain confidence in their reading word problems more carefully. I feel confident that my students have a better grasp of these Algebra concepts because of Algebra Nation.”
- “Students are more confident in skills taught previously without the support of algebra nation. I have had students comment on how much they appreciate learning concepts in class and then going home to reinforce skills.”

One respondent offered the following quotes from her or his own students:

- "I like Algebra Nation and I think it is a useful tool. I wish I had this before. It helps me see how I am supposed to work problems out."
- "I love it. It has helped me better understand and get the concept of algebra. Having the help/seeing the explanation of the work "
- "Algebra nation is a really good tool that will help you seceded in Math. It will help you understand the things that you need to understand. The tutors on algebra nation go slow and they break down the material that is being taught so that you can understand it. Algebra nation has helped me on so many different levels. It has helped me in my school work to learn how to solve the equations that I need to solve and it has helped me learn the material better. The way that the tutor Kiana broke everything down and explained it helped me to better understand the material. What I found beneficial about algebra nation was that their [*sic*] was tutors. The tutor I chose was Kiana. Kiana Broke [*sic*] everything down and has helped me to learn and understand the material that I didn't understand before. Yes algebra nation is amazing and

anyone who is is [*sic*] having trouble with Math. I highly recommend that they use Algebra Nation."

Teacher related factors, such as how the resources influenced the teacher, were cited by 11 or 20% of those commenting. Sample comments included:

- "It provided with me with more different style of questioning so I could do more questions like that in my lessons and warm ups"
- "Previously, my students struggled with graphing linear inequalities and their systems, but I heavily utilized Algebra Nation videos and activities during this unit, and I saw a tremendous growth in their understanding of this topic"
- "Algebra Nation has exposed our students to a rigorous content. It has pushed me as a teacher to provide that curriculum to my students as well. Algebra 1 is more than just a skill set, it is applying that skill set."

Related to teacher factors, **Question 22** asked respondents to rate four professional support features provided by Algebra Nation. Each of the four features had average ratings in the High or Very High range with no more than 12 respondents rating support as Low or Very Low. Where Very High was assigned 1, High 2, Medium 3, Low 4, and Very Low 5, all averages were between 2.03 and 2.10. Support for teachers and students as well as with technical or curriculum issues were all rated highly by respondents.

Q22 Rate the following professional support features provided by Algebra Nation.

Answered: 123 Skipped: 13

	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW	TOTAL	WEIGHTED AVERAGE
Support for my use of Algebra Nation resources	41.46% 51	19.51% 24	31.71% 39	4.88% 6	2.44% 3	123	2.07
Technical support for log-in and access issues	38.52% 47	26.23% 32	25.41% 31	6.56% 8	3.28% 4	122	2.10
Technical support for curriculum issues	38.84% 47	23.14% 28	33.06% 40	1.65% 2	3.31% 4	121	2.07
Support for my students' learning of algebra	40.16% 49	23.77% 29	31.15% 38	2.46% 3	2.46% 3	122	2.03

Respondents' opinions on continuing to provide Algebra Nation materials to students and teachers were gathered through **Question 23**. A notable majority, 90%, of respondents indicated that providing Algebra Nation materials, based on the past year's experience, should be a high or moderate priority with 52% indicating a "high priority" and 38% a "moderate priority." 13 or 10% of respondents selected "low priority."

Q23 Which of the following represents your opinion on whether Algebra Nation materials should continue to be provided to South Carolina students and teachers:

Answered: 128 Skipped: 8

ANSWER CHOICES	RESPONSES	
Providing Algebra Nation materials is a high priority because they are essential to my students and me.	51.56%	66
Providing Algebra Nation materials is a moderate priority because they are useful but not essential.	38.28%	49
Providing Algebra Nation materials is a low priority because they are not useful to my students or me.	10.16%	13
TOTAL		128

Question 24 asked for comments on how respondents would improve Algebra Nation materials. 104 respondents offered comments. 27 respondents or 26% of those commenting indicated that no improvement is needed and cited positive features of Algebra Nation.

Some comments included:

- "Every suggestion I have given to Algebra Nation, they have considered and made changes that were appropriate. The Algebra Nation team is very helpful and open to suggestions."
- "nothing - I think they are fine as is"
- "The workbooks were amazing! I hope this is a resource that we get to keep."

30 respondents (29% of the total) of those commenting called for more resources to be provided. Sample comments included:

- "More quizzes and test yourself opportunities. "
- "More diagnostics tests that lead students to specific videos and materials. Then another diagnostic to see if they have learned."
- "The Algebra Nation workbook should include more practice problems within the workbook. At least three to five more problems per topic would give the students more practice on each topic. One or two quizzes included through each section would be a great checkpoint."
- "Teacher Hard Copy of all Printable Resources (Quizzes, Practice, Etc) "
- "Use it more like a daily lesson plan instead of current text books. Make it easy to connect to power school grade book so as students finish assignment they would post to the students' grade."

Other suggested improvements called for more and better professional development or training of teachers to use Algebra Nation (9 respondents or 9 % of those commenting), revising the topic sequence to match a particular school or district (7 respondents or 7% of those commenting), and improved access to technology required for using Algebra Nation (5 respondents or 5% of those commenting).

23 respondents (22% of those commenting) addressed specific improvements such as perforated workbook pages, expansion to 8th grade mathematics, and editing.

Questions 24 to **30** addressed demographic information about the respondents and results were reported earlier in the **Methods and Instruments** section of this report.

The final survey item, **Question 31**, was not a question but provided space for comments or other information that would be valuable to those evaluating the effectiveness of Algebra Nation in South Carolina schools. Fifty-seven (57) respondents provided comments and 41 (72% of those commenting) cited positive elements and support for using Algebra Nation. Sample comments included:

- "We need to do everything we can to give our students a good foundation for their high school math courses. Algebra 1 is the foundation for all future math classes. The more formats that we can use to reach our students the better. I am very impressed with the rigor of material and how aligned it is to our standards. "
- "I believe from my colleagues who used it that AN is a wonderful program that provides challenging problems and a variety of ways to use the videos, expert helpers, Study Guides in order to help any type of student (ones that are ready for a challenge to those who need remediation). Please keep it for 2-5 more years so that teachers can get familiar with the program!"
- "This program is a HUGE benefit to my students. If they do not understand something in class they go on to Algebra Nation to find the video that goes along with it. Also it helps me to make sure that the rigor is there in all assessments because I go through the Test It questions myself to make sure that I understand how to do everything and am covering all that my students need to know. I use the Test its in class as a quiz after we have completed an entire section."
- "I don't think Algebra Nation is a gimmick. Used appropriately, it has been good for the students who have taken advantage of it. I think it would be worth the money to provide this program another year. I don't think you can determine its effectiveness after 1 or 2 years. It takes 3 years to fully implement new technology in the classroom. I am just understanding much of what the program can do and already have ideas for how to improve my use of the program for next year. Our special education department has found it helpful with our students and have commented that they wished there was something for geometry and algebra 2 as well."
- "This is the first curriculum provided to our South Carolina teachers and students that completely provided lessons and problems that correlated to all of the South Carolina Algebra 1 standards. Thank you for this resource."
- "I also thought the incentives are great that the kids can win. The ipads, donut parties, and pizza parties all created a "buzz" among my students about math. Anything that creates a buzz about math is awesome. I loved having this resource for my students and I really hope SC will keep using it. Algebra I standards encompass so much now that it is wonderful to have extra places for students to go and receive help. In addition, it has been nice for me as a teacher to go and look on there for ideas about a type of problem to go with a certain concept. I'm so glad my students had access to Algebra Nation this year!"

Two comments addressed district level weaknesses in the area of technology access. For example, one respondent was impressed by the resources but was unable to make full use because of technology problems:

- "I admire the pacing and real-world connections. Unfortunately, I could not make use of it because of the problem with getting access at the right time. I truly love to use if those problems are fixed prior to the first day of school."

Classroom Observations

Data gathered from observations of teachers using Algebra Nation materials with students in their schools' classroom are presented in this section. A copy of the observation instrument used is provided in **Appendix B**, and detailed observation reports along with the completed observation instrument is provided in **Appendix C**. Discussion and conclusions drawn from this data with respect to the final three research questions of this evaluation study are provided in the section that follows.

Teachers who were observed using Algebra Nation materials addressed important mathematical practices included in the South Carolina College and Career Ready Standards for Mathematics and measured by the *Mathematics Classroom Observation Protocol for Practices* (*MCOP*^{2}) instrument. These mathematical practices are critically important to students' growth and success in mathematics because the practices empower students to use mathematics as part of their lives and develop the habits of mind to think mathematically. However, mathematical practices are not easily or typically assessed as part of End of Course testing.

The eight teachers were observed using *MCOP*^{2} and averaged 2.21 on a scale where 0 indicated that addressing the practice was not observed and 3 indicated full or exemplary instruction addressing of the practice. It is normal for some practices to not be addressed or used as part of a particular lesson, and an average score of above 2 indicates that practices are given attention by the observed teacher. The range of average scores for the eight teachers was between 1.50 and 2.94.

A summary of the scores with teacher identification removed for each item on the *MCOP*^{2} form is provided in **Table 14** along with summary totals for Student Engagement (SE) and Teacher Facilitation (TF) as well as averages for each teacher, each item, and the group. Teachers observed using Algebra Nation scored 2.22 on items addressing student engagement with 4 of the 8 teachers scoring above 2.6. The types of engagements observed involved mathematical problem solving, using different representations of mathematics, having students use different strategies, and a climate in which students were respectful of each other's ideas. Teachers also facilitated the development of mathematical practices scoring 1.92 on average with 4 of 8 scoring above 2.3. Teachers encouraged students to use different strategies, addressed conceptual understanding, and fostered an environment in which students were respectful of their peers' thinking.

Mathematical modeling was a notable exception to the otherwise positive instruction on practices. None of the observed teachers made modeling an integral part of the observed lesson and only two were observed addressing modeling. Encouraging students to use multiple paths to solutions or using problems that had multiple solutions received an average score of 1.88 with only three teachers scoring a 3 on this item.

Table 14: *MCOP*^{2} to Results for Observed Teachers
Source: http://jgleason.people.ua.edu/uploads/3/8/3/4/38349129/mcop%5E2_protocol_descriptors_2-16-2018_update_final.pdf

	TEACHER:	One	Two	Three	Four	Five	Six	Seven	Eight	ITEM Averages
ITEM	**Item Description**									
SE 1	Problem Solving	3	2	0	1	3	3	3	3	**2.25**
SE 2	Representation	3		2	2	3	3	1	3	**2.43**
SE 3	Activities	3	3	3	3	3	3	3	3	**3.00**
SE 4	Students' Math Strategy	3	2	3	1	3	3	0	3	**2.25**
TF 4	Teachers' Math Strategy	3		3	1	3	3	0	3	**2.29**
SE 5	Perseverance	2		0	2	3	2	2	3	**2.00**
TF 6	Concept Understanding	3		3	3	3	3	1	3	**2.71**
TF 7	Mathematical Modeling	0		1	0	0	0	0	2	**0.43**
TF 8	Mathematical Structure	3		3	1	3	3	0	3	**2.29**
TF 9	Multiple Solution Paths	1	1	3	0	2	3	2	3	**1.88**
TF 10	Mathematical Precision	3		3	2	3	1	2	3	**2.43**
TF 11	Students' Thinking	2	1	2	2	3	2	2	3	**2.13**
SE 12	Students' Talk	3		3	1	3	3	1	3	**2.43**
SE 13	Student Climate of Respect	3	3	3	1	3	3	1	3	**2.50**
TF 13	Teachers' Foster Respect	3		3	2	3	3	1	3	**2.57**
SE 14	Wait Time	2		3	3	2	3	0	3	**2.29**
SE 15	Students' Communicate	2	2	3	0	3	3	0	3	**2.00**
TF 16	Teachers' Uses Questions	3	2	2	2	3	2	0	3	**2.13**
SE Total (9)		**24**	**12**	**20**	**14**	**26**	**26**	**11**	**27**	
TF Total (9)		**21**	**4**	**23**	**13**	**23**	**20**	**8**	**26**	
TOTAL		**45**	**16**	**43**	**27**	**49**	**46**	**19**	**53**	
Average (0-3)		**2.50**	**2.00**	**2.39**	**1.50**	**2.72**	**2.56**	**1.06**	**2.94**	**2.21**

Overall there was clear evidence that teachers using Algebra Nation for the observed lessons were addressing most of the mathematical practices as part of the observations. It is neither practical nor expected that each or all practices be addressed within particular lessons, so the evidence for each of the single observation was positive with respect to practices. All students in classes of the eight observed teachers (average score of 3.0) spent two-thirds or more of the observed lesson engaged in meaningful mathematical activities appropriate for Algebra 1. Also, 6 of the 8 teachers (average score of 2.71) facilitated conceptual understanding of fundamental algebra concepts helping students understand the "why" behind the procedures they were learning. Both of these practices were directly impacted by the use of the Algebra Nation videos that include engaging activities that foster conceptual understanding. However, mathematical modeling was not observed being used in 6 of the 8 lesson (average score of 0.43). The lack of attention to mathematical modeling, while not unique to Algebra Nation, indicates an area for growth in the teaching of algebra.

Observation Reports documented the teaching and learning observed during the lessons that used Algebra Nation resources.

Observed Teacher One used a *Guess My Rule* activity to engage students and promote understanding of functions. She commented to the observer on how Algebra Nation videos helped her address mathematics content when substitute teachers are employed during her time away because of illness or professional development.

Observed Teacher Two used of learning stations to differentiate students' needs, particularly a small group of Spanish speaking students. **Observed Teacher Three** used videos to supplement his own instruction as part of classroom learning pausing the video to explain. This technique allowed him to notice students' confusion or problems as the video instructor explained and he observed students working.

Observed Teacher Four used Algebra Nation to facilitate small-group instruction that differentiated students' needs including the use of the Test Yourself! Practice Tool with solution videos. Internet access at home and his school's technology infrastructure prevented higher levels of implementation.

Similarly **Observed Teacher Five** employed Algebra Nation to facilitate small group learning in a manner that differentiated students' needs and varied the instructional approach. The Algebra Nation approach to teaching binomial multiplication challenged the teacher to employ a method that fostered her students' conceptual understanding of a procedure instead of memorization of a method with a "trick." The teacher commented on how the videos helped her develop new and better teaching methods.

Algebra Nation instruction helped **Observed Teacher Six**'s emphasis of conceptual knowledge in addition to developing procedural fluency. His use of video instruction provided an alternative and high quality instructional approach that supplemented his own teaching.

Observed Teacher Seven shared with the observer the instructional challenge she noticed of her students watching videos but writing responses into their workbooks without thinking about what they were writing. She developed a method of having students stop the video at a particular timecoded points in the video to allow her students to think and write a response after reflection. The teacher used a variety of student groupings because the videos allowed small groups to receive instruction and

progress while she worked with individuals students or a group. This experienced teacher in her 29th year indicated that Algebra Nation challenged her to raise the rigor of the algebra content and to provide different methods that improved her instruction.

Observed Teacher Eight used Algebra Nation videos in a manner that allowed her to attend to students' learning while the primary instruction was provided by the video instructor. This allowed the teacher to detect misconceptions among her students. The district mathematics supervisor indicated that the Algebra Nation resources helped this teacher and other high school teachers at the district address Algebra 1 standards appropriately and with rigor as well as developing new and improved teaching skills. The supervisor indicated that the sequence of instruction on polynomials influenced a change to the district's instructional pacing guide.

Observed Teacher Nine indicated to the observer that scheduling the school computer lab was a challenge at her school where students did not have laptops or tablets. This limited the use of Algebra Nation resources for her classes. The limitation of access, in the teacher's opinion, would also limit the impact on end-of-course test scores. Another mathematics teacher at the same school indicated that Algebra Nation would allow her to plan instruction for her upcoming maternity leave that would allow a substitute without high school mathematics teaching expertise to manage classes and maintain student learning.

Observed Teacher Ten assigned videos for viewing outside of class, but also used videos in class, co-teaching with the video expert. The teacher valued being able to use different teaching styles and mathematical perspectives: her own and those of the Algebra Nation video instructors. Her use of Algebra Nation influenced her to emphasize attention to students' conceptual understanding and provided more real world examples tied to algebra content. The Test Yourself! Practice Tool, the Algebra Wall, and the Boot Camp all motivated the teacher's students to perform.

Discussion, Conclusions, and Recommendations

This final section of the evaluation report includes a discussion and conclusions about student achievement and teaching based on the data presented in the earlier Results sections. The section ends with recommendations about Algebra Nation use in South Carolina.

Discussion and Conclusions about the Impact on Student Achievement

The results derived from the EOCEP Algebra 1 examination provide evidence in response to the research questions posed about student achievement in Algebra 1:

1. **Does access to or use of Algebra Nation materials positively impact the performance of South Carolina students in Algebra 1 and Intermediate Algebra courses on the End of Course Education Program (EOCEP) Algebra 1 examination?** Specifically, do students with access to Algebra Nation materials, on average, score higher than those without access or higher than comparable students from the prior year? Do students whose teachers use Algebra Nation materials with fidelity score higher than comparable students from the prior year?

2. Do EOCEP Algebra 1 examination scores suggest a differential impact of Algebra Nation materials on South Carolina student subgroups (e.g. White-Black-Latino, ELL-NonELL, middle-high, Algebra 1-Intermediate Algebra, male-female)?

3. Are there component parts of Algebra Nation (e.g., videos, test practice tool, Algebra Wall) that have a higher association with student performance on the EOCEP Algebra 1 examination than the other components?

Students in school districts that had access to Algebra Nation materials did not score higher on the EOCEP Algebra 1 examination in 2017-2018 than students in the same district the prior year or in comparison to districts that did not have access to Algebra Nation materials. However, students taught by teachers in 23 of 45 schools who used Algebra Nation materials consistently and extensively demonstrated gains scoring higher means than the prior year and the mean score for all schools equaling that of the prior year when the state average fell one point. Also, for schools where teachers used Algebra Nation with fidelity, increased mean scores were found in the results for students in an Algebra 1 course and for students in middle schools as well as for Black/African-American students whose mean scores were higher than the state average for the same year. However, scores for students in the Intermediate Algebra course and for student in high school as well as for Hispanic students were below the state average for respective groups.

Access to Algebra Nation materials did not ensure active or effective usage by students and teachers. While data indicated that over 2,000 teachers logged into Algebra Nation, access was provided to all teachers in many subjects at middle and high school teachers with approximately 90%, most not algebra teachers, never logging into Algebra Nation and fewer than 5% logged in 5 or more times during the school year. Similarly, 64% of the students in districts with access to Algebra Nation never logged in to use the materials and only 13% of students logged in 5 or more times. For these reasons, drawing conclusions based on access to Algebra Nation materials is not an appropriate evaluation of impact as there is no assurance that Algebra Nation materials were used at all or in a manner that might affect test performance.

A group of 97 algebra teachers in middle and high school were identified to have made active and meaningful use of Algebra Nation materials over the 2017-2018 school year. **For this group, there was some evidence from students' test scores of a positive impact from using Algebra Nation materials.** A slight majority of schools (23 of 45) experienced higher mean scores from the prior year when the state mean dropped by one point. The increase was significantly higher for 4 of the schools. **The increase was most pronounced in middle schools** were 10 of 16 schools experienced gains and 3 were significantly higher. Mean scores at the high school level dropped 1.0 points consistent with the overall state performance, but mean scores at the middle school level increased by 1.6 points. Mean scores for students in Algebra 1 courses increased by 0.2 points largely on the basis of students who took Algebra 1 in middle school whereas mean scores for students in the Intermediate Algebra course dropped 2.4 points.

A group of 60 teachers at 34 schools from the group who used Algebra Nation with fidelity taught Algebra 1 or Intermediate Algebra classes at the same school both in 2016-2017 and in 2017-2018. **For these teachers, the overall difference in mean scores from the prior year was 0.3 lower when the state mean was one point lower.** Mean scores for high schools dropped significantly from the prior year, but means for middle schools increased significantly. Mean scores for Intermediate Algebra classes were significantly lower, but means for Algebra 1 classes were essentially the same, again when the state mean dropped one point. Seventeen (17) of the 34 schools experienced gains in mean scores from the prior year with 5 having significantly higher increases. Eighteen (18) of the 34 schools experienced lower mean scores with 6 being significantly lower.

There was no evidence of differential impact on test scores by gender or English Language proficiency. Mean scores for male and female student were consistent with the overall state performance. Students identified as having limited English Language proficiency also performed comparable to the statewide mean. In terms of culture or race, **Black or African-American students whose teachers made active use of Algebra Nation exceeded the statewide mean for comparable students though scores for four other groups of students were lower than the respective statewide means.** Similarly for the very small group (22) of American Indian and Native American students, mean scores were higher than the statewide mean. Multi-race students matched the statewide mean for other multi-race students. Asian, Hispanic, Native Hawaiian/Pacific Island, and White students scored lower than the statewide mean for comparable students.

The analysis of how using different Algebra Nation components by teachers and by students related to EOCEP Algebra 1 test score performance indicated some correlations that may suggest that usage positively impacted higher scores. **Teachers logging into Algebra Nation as well as accessing the teacher area had the highest correlations with test scores (0.30 and 0.36, respectively) indicative of a relation worthy of further study.** Data on teacher usage of other Algebra Nation components also correlated positively with test scores but the correlations were very low. Overall, one may conclude that logging in more did correlate with higher test scores for the teachers who implemented Algebra Nation with fidelity.

For students of the teachers who implemented Algebra Nation with fidelity, viewing instructional videos outside of school hours and completing the Test Yourself! Practice Tool component had high correlations (0.48 and 0.49, respectively) with test scores. The high correlations might be attributed to student motivation and not necessarily from the instruction received from the materials. Students posting on the Algebra Wall during school and outside of school or receiving Karma Points also correlated positively with test scores, but not as strongly (0.14, 0.26 and 0.28, respectively). Other

student usage variables correlated at near zero levels indicating no relationship with test performance. There was a negative correlation between students starting the On Ramp remediation component but not finishing (-0.17) but this too might be a factor tied to student motivation and not the On Ramp materials. It seems possible that students who do not persist to finish On Ramp are also likely to be among the weaker test performers. **A conclusion to be drawn from the student usage correlations is that students participating in the Test Yourself! Practice Tool component and who viewed videos outside of school correlated strongly with higher test scores.**

From this data, one may conclude that providing access to Algebra Nation materials did not positively impact EOCEP Algebra 1 test scores, but students whose teachers made active and meaningful use of the materials experienced slight gains with the most gains at the middle school level and among Black/African-American learners.

Some **limitations** inherent to the evaluation should be noted. **The results of this evaluation were limited to comparisons of mean scores of students at the level of their teachers, school, or the district.** Algebra Nation usage is, by design, flexible and varies significantly among students, teachers, schools, and districts. An ideal evaluation would have examined individual student test performance in relation to the individual student's use of Algebra Nation components. Such an evaluation was not possible for this report because South Carolina EOCEP Algebra 1 examination publicly released data cannot include individual student identifiers. South Carolina individual districts may release data with student identifiers, but a pilot study conducted at the end of the Fall 2017 semester indicated that responses from districts were limited and even those responding included student identifiers that were not always consistent with Algebra Nation student identifiers.

A truism among evaluation professionals is that in the first year of any implementation of innovative curriculum, the only ones learning are the implementers. **Many issues arise during the first year of implementing an innovation that must be addressed leading to a less-than-ideal implementation.** In the surveys, some teachers commented on the access problems and how they felt better prepared to begin the next school year using Algebra Nation.

Overall, the results based on analysis of test score performance from the first year of implementing Algebra Nation materials were not negative, and there were positive impacts for Algebra 1 courses, at the middle school level, and for Black/African-American students. This suggests continued implementation and evaluation of the impact of Algebra Nation on EOCEP Algebra 1 test scores particularly during and after the 2018-2019 school year.

Discussion and Conclusions about the Impact on Teaching

The results derived from the South Carolina Algebra Nation Teacher Survey and the Classroom Observations provide evidence in response to the final three research questions posed about impact on the teaching of Algebra 1:

1. Do teacher perceive that particular component parts of Algebra Nation (e.g., videos, online help, Algebra Wall) impact student performance on the Algebra 1 EOCEP greater than others?

2. What types of student or teacher engagements with the different components of Algebra Nation are required in order to impact student performance in Algebra 1?

3. Do South Carolina teachers of Algebra 1 whose students use Algebra Nation materials consider the materials useful to their work?

Teacher survey.

Data from the teacher survey indicated that **many (60%) of teachers responding made use of Algebra Nation materials at least once every two weeks, but different issues or concerns prevented more extensive use. Technology access or reliability at the school or district level was a primary issue, and alignment of the Algebra Nation content sequence to district pacing or curriculum guides were cited as concerns**, but the number of respondents citing concerns was much smaller (between 11% and 19%) than those citing reasons for using Algebra Nation. There was no evidence from the survey that technology access concerns emanated from Algebra Nation, and the problems cited involved insufficient access to computers or devises for students as well as some problems with district level Internet reliability.

While more than half of teachers responding to the survey used Algebra Nation videos as part of whole-class instruction, follow-up questions did not indicate that teachers were making creative or varying uses of the video as part of the instructional approaches. The use of the videos through a learning center, for lesson introduction, or as a quiz follow-up was done by between 30% and 34% of respondents. However, **there was evidence of wide use (more than 62%) as a lesson component or entire lesson or as an alternative or second teaching method.**

The **Algebra Nation Workbook and instructional videos were clearly used most extensively** by survey responders **as was the Test Yourself! Practice Tool**, but the On Ramp Study Guide and Algebra Wall as not used as extensively. **The On Ramp guide was cited by observed teachers as valuable but not as well known.**

Comments from responders to the survey documented the strength of Algebra Nation for providing teachers with alternative teaching methods or support for instruction through the videos and workbook as well as instruction that was rigorous and with high expectations. It was clear from the survey that those responding found the resources to be consistent with South Carolina algebra standards and that the resources benefited the students and teachers. **A remarkable 96% of respondents indicated that the Algebra Nation materials were appropriately aligned with South Carolina Algebra 1 standards and, furthermore, the materials were considered rigorous and appropriately challenging.**

Limitations were cited by less than 20% of respondents and included **concerns for determining how to use the many resources as well as technology access**, both also cited by observed teachers. Survey responders (11%) also commented on concerns about how the Algebra Nation resources were sequenced when the sequence may not have matched a district's guide. There will always be variation to the sequencing of content, and there was no evidence of errors in how Algebra Nation materials were sequenced. Many teachers indicated an ability to apply the flexibility inherent to the Algebra Nation resources to meet the needs of their students or the expectations of their schools or districts. Supporting teachers in the process of implementing the resources in a flexible manner might address this concern.

Close to 80% of respondents indicated that Algebra Nation had a positive impact on their students' learning in algebra. Two-thirds of respondents indicated that they believed Algebra Nation use would

positively impact their students' EOCEP Algebra 1 test scores, and almost all of those indicated that they had evidence to support this belief. For those who indicated a lack of impact, the lateness of their implementing the materials or the fact that the survey was administered prior to receiving EOCEP Algebra 1 results were cited. However, a few teachers, less than 3% of respondents, indicated that they prefer other materials.

Professional development and support by Algebra Nation were rated highly by survey responders with more than 60% rating the support, both technical and professional, as Very High or High in quality. Low or Very Low ratings were given by no more than 8% or respondents except for some 10% that cited log-in or student access problems.

Ultimately, 90% of respondents felt that providing South Carolina teachers with access to Algebra Nation should be a high or moderate priority with 52% making it a high priority and 38% a moderate priority. Comments supporting this response cited the high quality of the Algebra Nation materials and support as factors for continued use.

Classroom observations.

From the classroom observations, evidence was found that **indicated teachers benefited from Algebra Nation resources and their teaching was impacted positively. The resources provided teachers with the ability to implement research-based methods for algebra instruction**. Examples such as the use of the area model for teaching binomial multiplication were observed in several classrooms and teachers commented that this method had allowed them to move away from a procedure that was more rote and less tied to conceptual understanding. Algebra Nation instruction also included many applications of algebra and real-world examples that teachers used and indicated as positive.

Evidence was found using the *MCOP*^{2} observation instrument that **teachers addressed the mathematical practices included in the South Carolina College and Career Ready Standards for Mathematics**. Most notable was the emphasis on addressing **problem solving** and the **use of different mathematical representations**. Both the Algebra Nation videos and the workbook included instructional approaches that impacted the observed teachers and their students.

An additional observed benefit derived from the use of Algebra Nation materials was **teachers' ability to differentiate instruction so as to address students' needs and abilities.** This included addressing cognitive needs by assigning video tutors who address instruction briskly for those students grasping ideas easily or assigning tutors who are more deliberate and detailed for those struggling to learn concepts. Also, culturally, the **Spanish language tutor allowed access to fluent instruction for students whose primary language is Spanish.** Differentiation also involved teachers employing **different student grouping strategies** such as small group or individualized work where the instruction is through video as well as co-teaching with the video instruction. Observed teachers also cited that the Algebra Nation videos allowed them to **plan and provide meaningful mathematics instruction during periods of their own absence from the classroom.** Substitute teachers capable of teaching high school algebra are rare, and observed teachers commented that access to the extensive video collection allowed them to plan lessons that non-mathematics experts could implement. This was done for absences due to illness, professional development, or maternity.

Teachers were observed using the projected video instruction as part of regular classroom instruction. Several benefits resulted from this instruction approach. Since the video instructor focused on the algebra content the live classroom teacher was able to focus on her or his students' learning of the

content. The classroom teacher could attend to both how the content was being presented through the video and to how students were learning the content as presented. Additionally, the video instruction served to develop teachers' knowledge not only of algebra content, but also of different approaches for teaching algebra. This was noted by a district mathematics supervisor who indicated that the Algebra Nation materials had served to develop the district's algebra teachers' knowledge of the South Carolina Algebra standards.

Lastly, observations indicated **that teachers made extensive and effective use of the practice materials provided by Algebra Nation.** The Test Yourself! Practice Tool was observed in use with students and every observed class made us of the Workbook. **Teachers commented on the value of the online resources materials with many lauding the use of the On Ramp diagnostic tool.** Several observed teachers commented that they had discovered the On Ramp tool later in the school year and planned on making more extensive and earlier use of this tool to identify individual student weaknesses.

Observations, however, noted a **lack of emphasis on the practice of mathematical modeling**. While teachers addressed problem solving typically using real world contexts and also emphasized applications of mathematics to other fields, both directly resulting from Algebra Nation materials, no teacher was observed addressing the mathematical model cycle in part or as a whole. The cycle as described in the 2016 *Guidelines for Assessment and Instruction in Mathematical Modeling Education* (GAIMME, https://www.siam.org/Publications/Reports/Detail/Guidelines-for-Assessment-and-Instruction-in-Mathematical-Modeling-Education) serves to develop students' ability to make algebra and mathematics meet their needs in solving problems and making decisions. Through the 6-step cycle (Figure 3.1, p. 46, GAIMME, 2016), students experience how algebra allows for predications and provides insights into the world in which students live and will work. Admittedly, few high school teachers are currently implementing the modeling practice, but **Algebra Nation through its videos and resource materials could positively impact this important and neglected mathematical practice.**

Recommendations

- **Continue to provide Algebra Nation to South Carolina school districts to improve teacher instruction and to impact test scores and improve instruction based on test score results** (positive results with Algebra 1 classes, for middle schools and for Black/African-American students as well as the consistent performance of students whose teacher implemented Algebra Nation with fidelity), **teacher survey responses** (citing the value to their instruction and increased rigor), **and classroom observations** (indicating attention to mathematical practices).

- **Evaluate the impact of Algebra Nation during the 2018-2019 school year** based on conclusions from the data analysis indicating only partial implementation of Algebra Nation during the first year.

- **Encourage use of the Test Yourself! Practice Tool** component and the viewing of videos outside of school based on the correlation of usage of these resources with higher test scores.

- **Improve school and district technology access** by expanding the number of tablets or laptops available to all algebra students and insuring reliable Internet access based on teacher responses to the survey and comments during observations.

- **Collaborate with the South Carolina Leaders in Mathematics Education to provide flexibility and consistency with Algebra Nation curriculum sequencing** that may vary with district algebra curriculum based on teacher responses to the survey.

- **Provide on-going support to help teachers implement the videos and other instructional resources** into their classroom teaching particularly the less used On Ramp Study Guide based on survey responses.

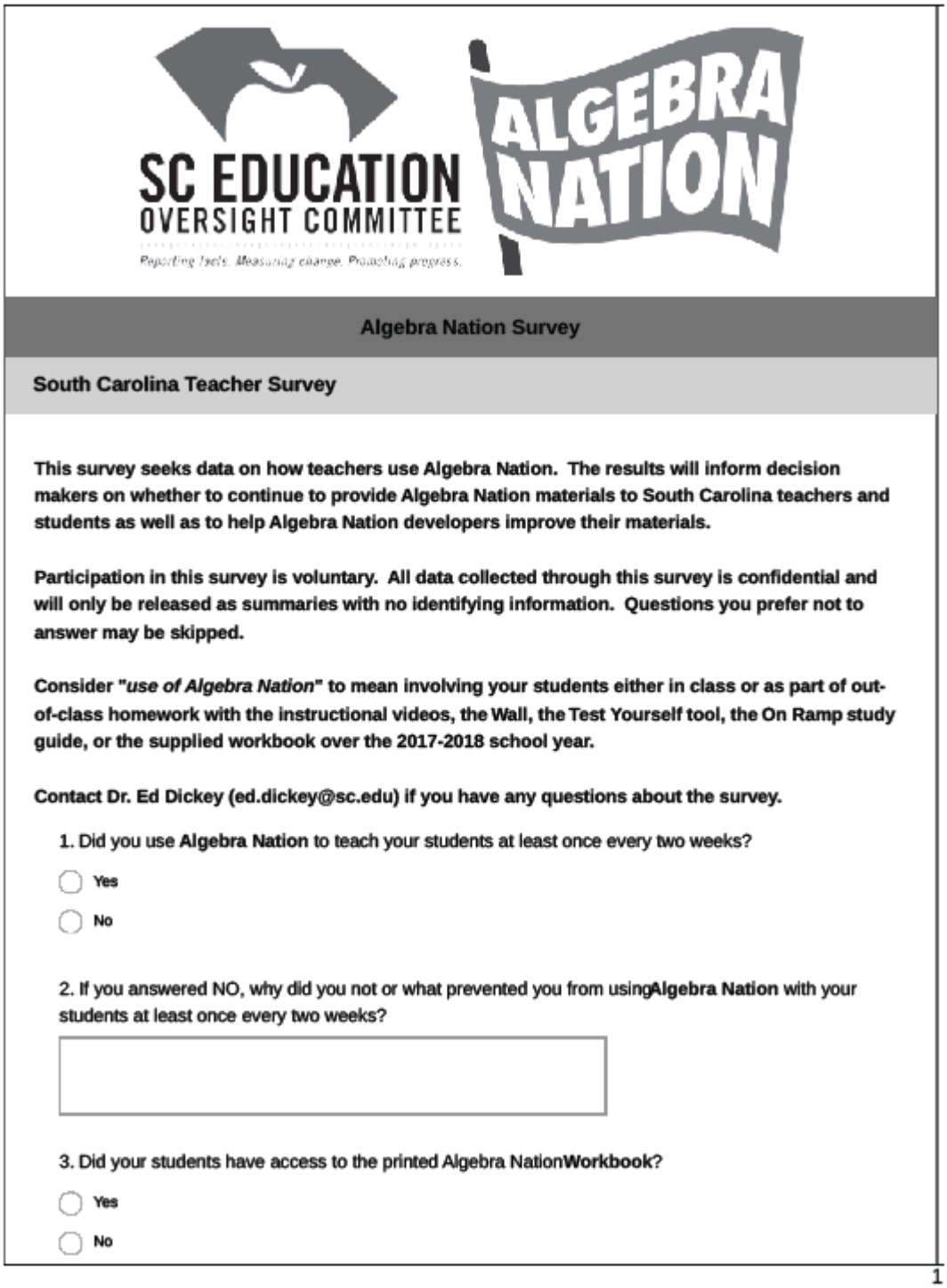
- **Expand** the already ample but still requested **support materials** to help students' practice for end of course testing based on comments to the survey.

- **Emphasize the differentiation of instruction and the use of different teaching methods as part of professional development**, and employ long term teacher development during the school year to allow and encourage the sharing of ideas for implementing these methods with all algebra teachers and encourage them to apply the methods during the school year based on survey comments.

- **Include resources** as part of video instruction as well as within the online support materials **that address mathematical modeling** based on classroom observations.

Appendix A

South Carolina Teacher Algebra Nation Survey



SC EDUCATION OVERSIGHT COMMITTEE

Reporting facts. Measuring change. Promoting progress.

ALGEBRA NATION

Algebra Nation Survey

South Carolina Teacher Survey

This survey seeks data on how teachers use Algebra Nation. The results will inform decision makers on whether to continue to provide Algebra Nation materials to South Carolina teachers and students as well as to help Algebra Nation developers improve their materials.

Participation in this survey is voluntary. All data collected through this survey is confidential and will only be released as summaries with no identifying information. Questions you prefer not to answer may be skipped.

Consider "*use of Algebra Nation*" to mean involving your students either in class or as part of out-of-class homework with the instructional videos, the Wall, the Test Yourself tool, the On Ramp study guide, or the supplied workbook over the 2017-2018 school year.

Contact Dr. Ed Dickey (ed.dickey@sc.edu) if you have any questions about the survey.

1. Did you use **Algebra Nation** to teach your students at least once every two weeks?

- ◯ Yes
- ◯ No

2. If you answered NO, why did you not or what prevented you from using **Algebra Nation** with your students at least once every two weeks?

3. Did your students have access to the printed Algebra Nation **Workbook**?

- ◯ Yes
- ◯ No

1

4. Which medium did you or your students primarily use to access the Algebra Nation electronic materials (**videos**, **Test Yourself**, **On-Ramp**, the **Wall**) whether in your classroom or elsewhere. Mark all that apply.

- [ ] Computers in computer lab
- [ ] Computer or computers in classroom
- [ ] Students' own device such as laptop, tablet, or cell phone
- [ ] School-owned tablet

Did you notice any limitations regarding access?

5. How frequently do you show Algebra Nation **instructional videos** to your entire class (perhaps through projection)?

- ( ) I did not show the Algebra Nation instructional videos to my entire class.
- ( ) Less than one in every five classes.
- ( ) One or more times in every five classes.
- ( ) Three or four times in every five classes.
- ( ) In every class.

2

6. Indicate the extent to which you used the strategies in the left-column below as part of showing the Algebra Nation **instructional videos** to your entire class:

	Not Used	Less than once in every five classes	One or more times in every five classes	Three or four times in every five classes	In every class
Used all or portion of an instructional video as a bell ringer/warmup activity.	○	○	○	○	○
Presented an instructional video prior to my own lesson instruction.	○	○	○	○	○
Presented all or part of an instructional video as a component of a lesson I taught.	○	○	○	○	○
Presented an instructional video followed by a quiz.	○	○	○	○	○
Presented an instructional video after teaching a lesson to reinforce concepts.	○	○	○	○	○
Used instructional videos for test review.	○	○	○	○	○
Presented instructional video as alternative or 2nd teaching method.	○	○	○	○	○
Used video as lead in to workbook practice problems.	○	○	○	○	○
Used video as follow-up to workbook practice problems.	○	○	○	○	○

7. Have you established a learning center within your classroom where one or more students were required to work on **Algebra Nation** materials?

○ Yes

○ No

3

8. How frequently do you have a student or student groups (2-6 students) work individually on the **Algebra Nation** website or tablet app during class time?

- ◯ I do not have students work on the Algebra Nation website or app during class time.
- ◯ Less than one in every five classes.
- ◯ One or more times in every five classes.
- ◯ Three or four times in every five classes.
- ◯ In every class.

9. Indicate how frequently you have a student or student groups worked individually on the following **Algebra Nation** materials during class time.

	Not Used	Less than once in every five classes	One or more times in every five classes	Three or four times in every five classes	In every class
Watched **instructional videos**	◯	◯	◯	◯	◯
Used the **Test Yourself** practice tool	◯	◯	◯	◯	◯
Used the **On Ramp** Study Guide	◯	◯	◯	◯	◯
Posted to the **Algebra Wall**	◯	◯	◯	◯	◯
Used the provided **Workbook**	◯	◯	◯	◯	◯

10. Indicate the extent to which you used the strategies in the left-column below as part of instruction with Algebra Nation printed **Workbook** practice problems:

	Not Used	Less than once in every five classes	One or more times in every five classes	Three or four times in every five classes	In every class
Used as a bell ringer/warmup activity	◯	◯	◯	◯	◯
Used as assignments for small group work	◯	◯	◯	◯	◯
Used as a diagnostic tool during class	◯	◯	◯	◯	◯
Used as opener for a lesson	◯	◯	◯	◯	◯
Used as assessment after a lesson	◯	◯	◯	◯	◯
Used as a test for final grade	◯	◯	◯	◯	◯

11. Indicate the extent to which you used the strategies in the left-column below as part of instruction with Algebra Nation **Test Yourself** Practice Tool:

	Not Used	Less than once in every five classes	One or more times in every five classes	Three or four times in every five classes	In every class
Used as a bell ringer/warmup activity	○	○	○	○	○
Used as assignments for small group work	○	○	○	○	○
Used as a diagnostic tool during class	○	○	○	○	○
Used as opener for a lesson	○	○	○	○	○
Used as assessment after a lesson	○	○	○	○	○
Used as a test for final grade	○	○	○	○	○

12. Indicate the extent to which you used the strategies in the left-column below as part of instruction with Algebra Nation **On Ramp** Study Guide:

	Not Used	Less than once in every five classes	One or more times in every five classes	Three or four times in every five classes	In every class
Used as a bell ringer/warmup activity	○	○	○	○	○
Used as assignments for small group work	○	○	○	○	○
Used as a review during class	○	○	○	○	○
Used as a review at school but outside of class	○	○	○	○	○
Used as assigned work for student at home	○	○	○	○	○
Used as opener for a lesson	○	○	○	○	○
Used as assessment after a lesson	○	○	○	○	○
Used as a test for final grade	○	○	○	○	○

5

13. Indicate whether or not you used the strategies in the left-column below as part of instruction with Algebra Nation **Algebra Wall**.

	YES	NO
Used Karma points or wall posts for extra credit	○	○
Used Karma points or wall posts for participation grades	○	○
Created Karma points competition	○	○
Used Karma points or wall posts for homework grades	○	○
Provided tutoring time in the evenings on the Algebra Wall	○	○

14. Indicate the extent to which you asked your students to watch specific Algebra Nation**instructional videos** at home or outside your classroom.

- ○ I did not ask students to watch specific Algebra Nation instructional videos at home or outside of class.
- ○ Less than one in every five classes.
- ○ One or more times in every five classes.
- ○ Three or four times in every five classes.
- ○ In every class.

15. Indicate the extent to which you assigned your students Algebra Nation printed**Workbook** practice problems as homework.

- ○ I did not assign students Algebra Nation printed Workbook practice problems as homework.
- ○ Less than one in every five classes.
- ○ One or more times in every five classes.
- ○ Three or four times in every five classes.
- ○ In every class.

16. Indicate the extent to which you assigned your students Algebra Nation printed**Test Yourself** tool as homework.

- ○ I did not assign students Algebra Nation Test Yourself tool as homework.
- ○ Less than one in every five classes.
- ○ One or more times in every five classes.
- ○ Three or four times in every five classes.
- ○ In every class.

17. Indicate the extent to which you assigned your students Algebra Nation**On Ramp** Study Guide as homework.

- ○ I did not assign students Algebra Nation On Ramp Study Guide as homework.
- ○ Less than one in every five classes.
- ○ One or more times in every five classes.
- ○ Three or four times in every five classes.
- ○ In every class.

18. Indicate the extent to which used Algebra Nation as a**remediation tool** with your students who might have struggled or were falling behind. Mark all that apply.

- ☐ I did not use Algebra Nation as a remediation tool.
- ☐ I assigned specific Algebra Nation **instructional video** to particular students *as homework.*
- ☐ I assigned specific Algebra Nation **Workbook** practice to particular students *as homework*.
- ☐ I assigned specific Algebra Nation **On Ramp videos** to particular students *as homework*.
- ☐ I assigned specific Algebra Nation **On Ramp Study Guides** to particular students *as homework*.
- ☐ I assigned specific Algebra Nation **instructional video** to particular students to *watch at school*.
- ☐ I assigned specific Algebra Nation **Workbook** practice to particular students to *use at school*.
- ☐ I assigned specific Algebra Nation **On Ramp videos** to particular students to *watch at school*.
- ☐ I assigned specific Algebra Nation **On Ramp Study Guides** to particular students to *use at school*.
- ☐ I provided before or after school assistance for students using Algebra Nation resources.

19. What did you find to be the main strength of**Algebra Nation**?

20. What did you find as the most significant limitation of**Algebra Nation**?

7

21. From your experience, what is your perception of how using **Algebra Nation** impacted your students' grades and confidence levels in algebra?

	YES	NO
Appropriately aligned to the South Carolina Algebra 1 standards	○	○
Algebra Nation materials are **rigorous** and appropriately **challenging**	○	○
Positively impacted my students' EOCEP Algebra 1 test scores	○	○
Positively impacted my students learning in the algebra course I taught	○	○
I found **evidence** that Algebra Nation has a positive impact on test scores, grades, or confidence levels	○	○

If you found evidence that **Algebra Nation** had a positive impact on test scores, grades, or confidence levels, briefly explain what you found:

22. Rate the following **professional support features** provided by Algebra Nation.

	Very High	High	Medium	Low	Very Low
Support for my use of Algebra Nation **resources**	○	○	○	○	○
Technical support for **log-in** and **access issues**	○	○	○	○	○
Technical support for **curriculum issues**	○	○	○	○	○
Support for my **students' learning** of algebra	○	○	○	○	○

8

23. Which of the following represents your opinion on whether **Algebra Nation** materials should continue to be provided to South Carolina students and teachers:

- ○ Providing Algebra Nation materials is a **high priority** because they are essential to my students and me.
- ○ Providing Algebra Nation materials is a **moderate priority** because they are useful but not essential.
- ○ Providing Algebra Nation materials is a **low priority** because they are not useful to my students or me.

24. If you could improve the **Algebra Nation** materials, what would you do?

25. When did you start using **Algebra Nation** with your students?

- ○ I did not use Algebra Nation materials with my students.
- ○ Fall 2017
- ○ Spring 2018
- ○ Before Fall 2017

26. During 2017-18, in what grades were the students you taught? Mark all that apply.

- ☐ 6th grade
- ☐ 7th grade
- ☐ 8th grade
- ☐ 9th grade
- ☐ 10th grade
- ☐ 11th grade
- ☐ 12th grade

27. During 2017-18, in what course did you use **Algebra Nation** materials?

- ☐ Algebra I
- ☐ Foundations of Algebra
- ☐ Intermediate Algebra
- ☐ Other (please specify)

9

28. How many years have you taught prior to this year (2017-18)?

- ◯ First year
- ◯ 1-2 Years
- ◯ 3-5 Years
- ◯ 6-10 Years
- ◯ 11-20 Years
- ◯ More than 20 Years

29. Are you a National Board Certified Teacher?

- ◯ YES
- ◯ NO

30. Did you enter teaching through an alternative certification program (PACE, ABCTE, Teach for America, etc)?

- ◯ YES
- ◯ NO

31. **Thank you** for taking the time to complete this survey and help us assess the impact of **Algebra Nation** for South Carolina students.

Please use the space below to **share any other information you feel will be valuable** to those evaluating the effectiveness of **Algebra Nation** in our state's schools.

10

Appendix B

Mathematics Classroom Observation Protocol of Practices (MCOP^2)
Teacher Observation Instrument

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description	Comments
3		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.	
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.	
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.	
0		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.	

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description	Comments
3		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.	
2		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were not explicitly discussed by the teacher or students.	
1		The students manipulated or generated one representation of a concept.	
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.	

3) Students were engaged in mathematical activities.

SE		Description	Comments
3		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)	
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.	
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.	
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.	

4) Students critically assessed mathematical strategies.

SE	TF	Description	Comments
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.	
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.	

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE		Description	Comments
3		Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.	
2		Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.	
1		Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.	
0		Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.	

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

	TF	Description	Comments
	3	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.	
	2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.	
	1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.	
	0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.	

7) The lesson promoted modeling with mathematics.

	TF	Description	Comments
	3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).	
	2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.	
	1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.	
	0	The lesson does not include any modeling with mathematics.	

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Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description	Comments
3	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.	
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.	
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.	
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.	

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description	Comments
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.	
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.	
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.	
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.	

10) The lesson promoted precision of mathematical language.

TF	Description	Comments
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.	
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.	
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.	
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.	

11) The teacher's talk encouraged student thinking.

TF	Description	Comments
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis*** : examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis**: requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.	
2	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills	
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.	
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.	

12) There were a high proportion of students talking related to mathematics.

SE	Description	Comments
3	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.	
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.	
1	Less than half of the students were talking related to the mathematics of the lesson.	
0	No students talked related to the mathematics of the lesson.	

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Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description	Comments
3	3	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.	
2	2	The environment is such that some students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.	
1	1	Only a few share as called on by the teacher. The climate supports those who understand or who behave appropriately. Or Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.	
0	0	No students shared ideas.	

14) In general, the teacher provided wait-time.

SE		Description	Comments
3		The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
2		The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
1		The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
0		The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE		Description	Comments
3		**Considerable time (more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.	
2		Some class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.	
1		The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.	
0		No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.	

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

	TF	Description	Comments
	3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.	
	2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.	
	1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.	
	0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.	

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

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Appendix C

Teacher Observation Reports and MCOP^2 Reports

1. Nicole Baxter, Honea Path Middle School, November 3, 2017
    a. Observation Report
    b. MCOP^2 Form

2. Jenell Riley, R.B. Stall High School, November 6, 2017
    a. Observation Report

3. Scott Carter, Southside Middle School, November 7, 2017
    a. Observation Report

4. Tom Mauldin, Cheraw High School, November 8, 2017
    a. Observation Report
    b. MCOP^2 Form

5. Wendy Major, Greenwood High School, January 11, 2018
    a. Observation Report
    b. MCOP^2 Form

6. Russell Saunders, Midland Valley High School, February 12, 2018
    a. Observation Report
    b. MCOP^2 Form

7. Kathi Haynie, Belton Middle School, February 13, 2018
    a. Observation Report
    b. MCOP^2 Form

8. Ashley Jacobs, Summerville High School, March 1, 2018
    a. Observation Report
    b. MCOP^2 Form

9. Sharon Gregory and Dana Jenkins, Midland Valley High School, March 14, 2018
    a. Observation Report
    b. MCOP^2 Form

10. Jennifer Porter, E.L. Wright Middle School, March 28, 2018
    a. Observation Report
    b. MCOP^2 Form

Algebra 1 Observation for Algebra Nation

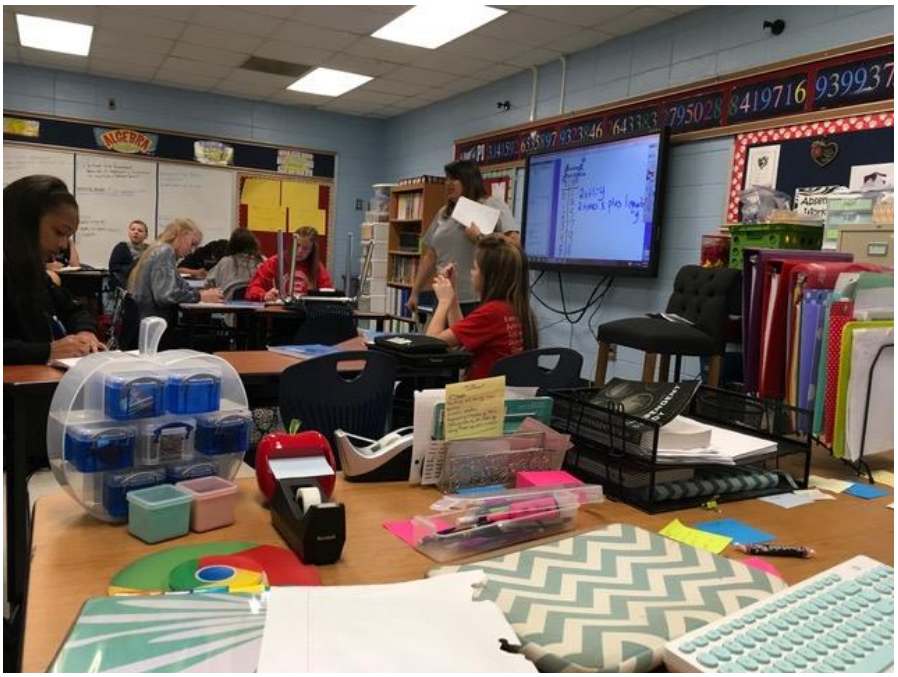
Nicole Baxter
Honea Path Middle School
3 November 2017

9:44 - 10:24 a.m. first block Algebra 1 class

Nicole Baxter is an experienced and confident middle school mathematics teacher. She completed a teacher preparation program at Georgia Southern University and participates in professional development through her district and Clemson University. This is her first year in the district but she has been teaching for about 5 years.

A large number of students are in this 8th grade Algebra 1 class, about 30. A *Guess My Rule* activity was displayed on the large screen video display at the front of the room. Ms. Baxter made announcements about past work, and then began the activity. She asked student to provide input numbers to which she gave an output with the intention of having the students guess the rule for the output. Students were to raise their hand if they knew the rule. She provided terms like domain and range and independent and dependent to describe the *x* as input and *y* as output.

Ms. Baxter described the forms or representations that she was writing on the display: table, algebraic, and word each representing the rule that was guessed. She explained how to see patterns and how the 0 input helps. She provided another example this time using the square of the input. Students were all interested and engaged in the challenge to guess the rule.



Ms. Baxter next provided each student with their **Algebra Nation (AN)** workbook. She asked students to go to the **AN** web site using their Chromebook. Each student had a Chromebook in a

case provided by the school. Internet access was slow and required screen refreshing. It was slower than usual. To adjust for the delay Ms. Baxter asked students to create a graph on paper for each of the *Guess My Rule* examples. The delay caused stress on Ms. Baxter as the students were not on task.

Ms. Baxter detected a network problem and instructed students to change the network host but access was not working. A firewall problem with the district internet access was a possible culprit or perhaps problems at **AN**. A district instructional coach was also observing and triede to help. Ms. Baxter indicated that access has not been a problem, and there was access earlier in the school day.

Students had been using **AN** in class and at home successfully. She shared with me how she integrates the state standards to the **AN** lessons. She also indicated that she uses the *On Ramp* feature with her Math 8 students as well as with some in Algebra 1. She finds **AN** very beneficial because for Algebra 1 she must address both the algebra course standards and the 8th grade math standards. Having the **AN** for her is like having another teacher to help.

Ms. Baxter focused on the alternative graphing activity to ensure student learning proceeded despite the original plan for using **AN** not being possible. A student commented he preferred the graphing to **AN**. Ms. Baxter used called "Strikes" maintain order and students responded with less talk and attention to the graphing task as she called strike 2. She stressed the importance of producing graphs with all 4 quadrants.

Homework from p. 55 of the **AN** workbook was assigned. Students were to watch the topic 1 video and answer questions.

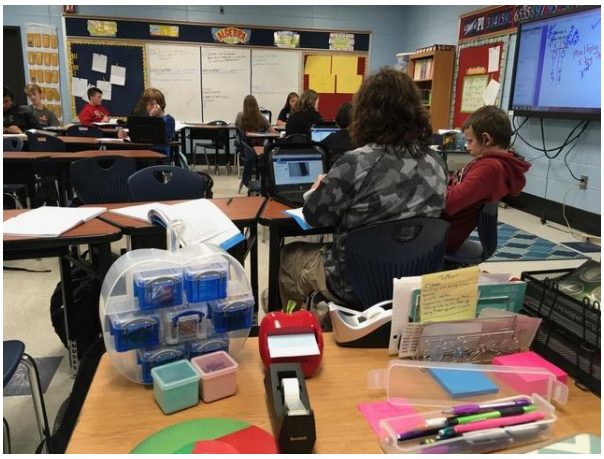
10:50-10:55 a.m. and 11:21-12:11 p.m. second block Algebra 1 class

This too was a large class with approximately 30 students. The Friday bell schedule called for an interruption of the class after about 5 minutes of instruction with students later returning for the rest of the class period.

AN workbooks were distributed to all students. The *Guess My Rule* activity was initiated for this class comparable to the first. Ms. Baxter referred to a **Desmos** assignment that students had done in a prior class and was ongoing. There was a break after 5 minutes for an assembly. Students returned after 30 minutes.

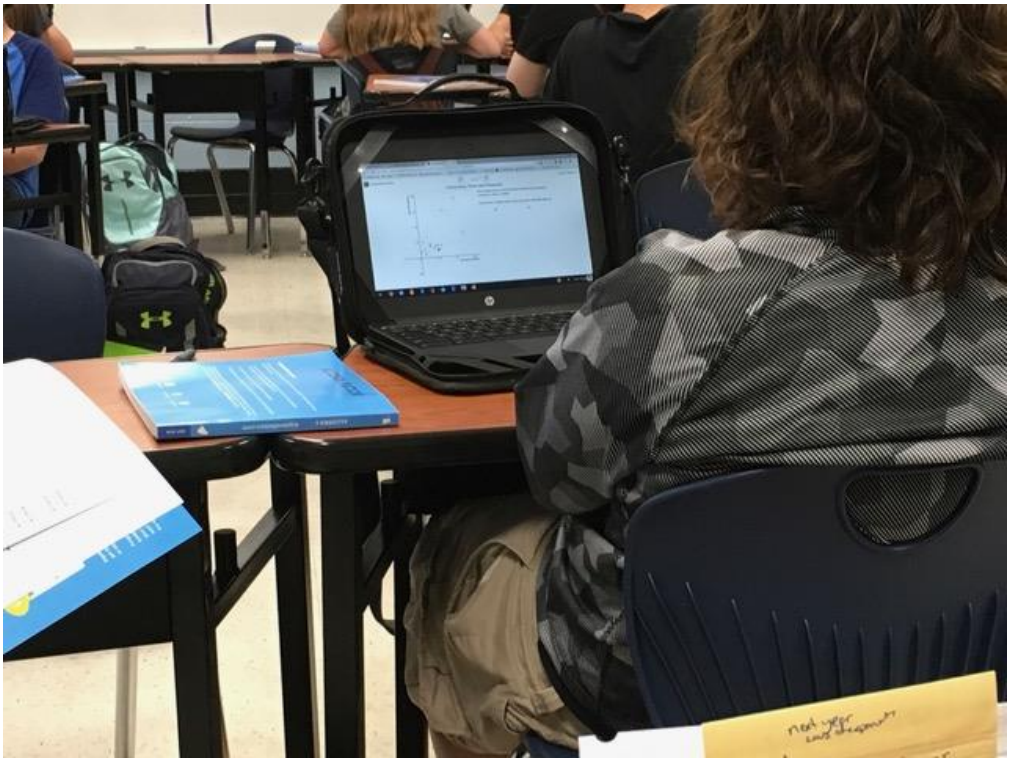
Ms. Baxter finished the second *Guess My Rule* example. She asked one student to try to access **AN**. She finished handing out the **AN** workbooks and had the students enter their names on each. She had the rest of the students log in with small groups of 5 doing so to avoid all logging on at once and potentially causing problems. She logged in on the main class display successfully. She asked students to turn to p. 55 of the workbook and directed them to go to the video in section 3, the introduction to functions, to watch the video and to take notes. She asked everyone to view Kiana, the video tutor, because she had previewed that video and the level was appropriate for her planned lesson. She instructed students to view the videos with earbuds. It is

21 minutes long and they were to pause as needed and to take notes. Those without earbuds were put outside in the hall or in another classroom to view.



Students were all on task with the individualized work using **AN** videos and the workbook. For the 25 minutes allotted for this work.

Ms. Baxter cited to me the benefits of **AN** when she is absent. She uses *On Ramp* in all her classes. She is noticing significant accomplishments this year over years past and attributes this to both **AN** use and her own growth in using more cognitively demanding tasks. The tasks have come from a professional development grant project through Clemson University (Dr. Megan Che) and through activities involving **Desmos**. As class ended students were told to save their progress to finish the work at home.



MCOP^2 Form for Nicole Baxter

Nicole Baxter / Honea Path MS 11/3/2017 11:15 - 12:15

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description
(3)		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
0		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments

Guess my rule
- lots of conjecture

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description
(3)		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
2		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1		The students manipulated or generated one representation of a concept.
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments

- table, alg, verbal w/ graph
- emphasized diff representations

3) Students were engaged in mathematical activities.

SE		Description
(3)		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments

almost all engaged throughout lesson

4) Students critically assessed mathematical strategies.

SE	TF	Description
(3)	(3)	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments

Ss thought critically about conjectures

Mathematics Classroom Observation Protocol for Practices (MCOP²)

5) Students persevered in problem solving.

SE		Description
3		Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
(2)		Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1		Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0		Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

The task did not require a great deal of perseverance

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

	TF	Description
	(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
	0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

functions & representations are fundamental & critical

7) The lesson promoted modeling with mathematics.

	TF	Description
	3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
	2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
	1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
	(0)	The lesson does not include any modeling with mathematics.

Comments

Mathematics Classroom Observation Protocol for Practices (MCOP²)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
(3)	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: - patterns were explained

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; **or** more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
(1)	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; **or** a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: true general solution path - suggested providing output to have students guess input

10) The lesson promoted precision of mathematical language.

TF	Description
(3)	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: attention noted with precise use of mathematical language

11) The teacher's talk encouraged student thinking.

TF	Description
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis*** : examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis**: requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.
(2)	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments:

12) There were a high proportion of students talking related to mathematics.

SE	Description
(3)	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: all were talking about math concepts

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description
(3)	(3)	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.
0	0	No students shared ideas.

Comments

14) In general, the teacher provided wait-time.

SE	Description
3	The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
(2)	The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
1	The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
0	The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.

Comments

The lesson pace was fast.

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE	Description
3	**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
(2)	**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
0	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

Comments

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

TF	Description
(3)	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.
2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.
1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.

Comments

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

- Inservice
- live
- 28 students in each of two classes
- 8th grad
- Honea Path Middle
- predominately white, some children of color

School Launch, Intermediate Algebra Observation, and Panel Discussions for Algebra Nation

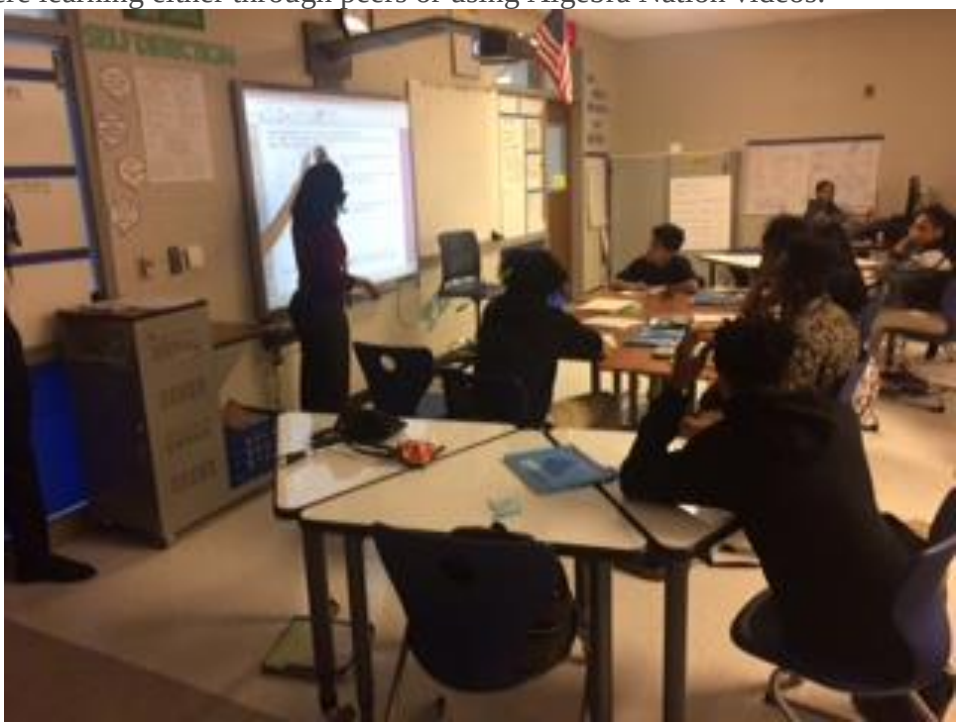
Pep Rally
8:45 – 9:15 a.m.
A pep rally with approximately 500 students to launch Algebra Nation was held in the school's Performing Arts Center. The rally was hosted by three of the Algebra Nation video instructors who provided positive comments about learning algebra. Students were interested and seemed pleased to meet the video teachers in person asking questions about them and cheering. At the end students gathered with the video teachers to take selfies and have autographs signed including the Algebra Nation workbooks.

Besides students, district office, local education, and state legislative leaders were also in attendance.

Ms. Jenell Riley's Intermediate Algebra Class
R.B. Stall High School
3 November 2017

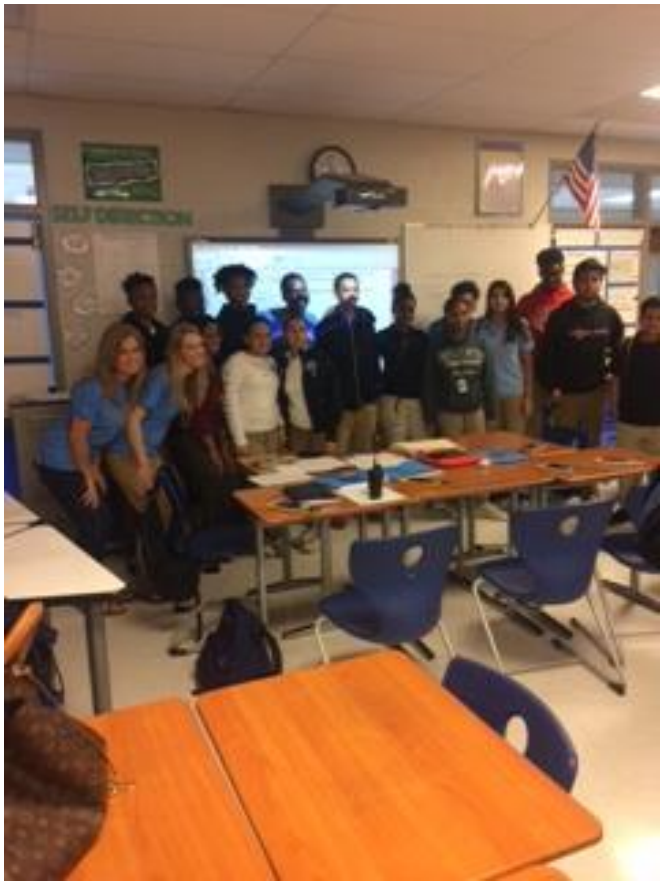
9:15 – 9:55 a.m.

After the pep rally visitors were provided the opportunity to observe two difference algebra classes. One class included a room at which the teacher, Ms. Riley, was providing instruction to a small group about finding average rate of change using a cost function while other groups of students were learning either through peers or using Algebra Nation videos.



One group of 5 Spanish speaking student (below, left) were posing problems requiring the use of the distributive property then solving them together. A different group of about 8 students were working at stations with either computers or tablets to view Algebra Nation videos. All students were engaged and on task. The Spanish speaking students were enthusiastic about their work.

At the end of the class period, students were eager to pose for a picture with the video instructors and their regular teacher.



10:00 to 11:00 Panel Discussion

A panel of 5 students were assembled to provide their perspective on Algebra Nation materials and to answer questions. The students expressed that they liked the ability to pace their own learning as well as the opportunity to peer teach, to explain algebra to other students because it helps them understand. The indicated that the viewed the videos at home, typically on their phones. They were very positive about the usage and even when pressed offered no criticism or suggestions.

After the students, a panel of 4 teachers provided their perspectives. This group included the teacher in whose classroom the observation occurred as well as another teacher who was observed by another group. A new teacher in her first year of teaching as on the panel as was a school administrator who prior to this year was the school's math department head.

The teachers expressed how much they liked the flexibility that Algebra nation provides them. They considered the resources as being comparable to having another teacher in the room with them. One teacher found Algebra Nation similar to a resource she used in prior years but the big difference was she noticed students "bought in" to Algebra Nation. They find the instruction and materials very engaging. The teacher also expressed that that the materials encouraged her to use more real world examples.

The school principal pointed out how beneficial it was for the teachers to be able to view the video instruction and he considered this to be a form a teacher development. The teachers agreed that they often learned new teaching methods and ideas from viewing the videos. It helped them think differently about how and what they taught. The first year teacher expressed how helpful and supporting it was to have the materials and contrast her success this first year to how difficult she found her student teaching to be.

One teacher pointed out the one day of professional development did not sufficiently prepare her for using Algebra Nation, but she agreed with the recommendation provided by Amy Adams to teach through an entire unit of study with Algebra Nation to establish the teaching strategies. She felt that after completing a unit, she was much better prepared.

A comment was made about how Algebra Nation provides teachers with formative assessment tools. A district office representative pointed out how the On Ramp tool is being used in middle grades to assess and help address math weaknesses.

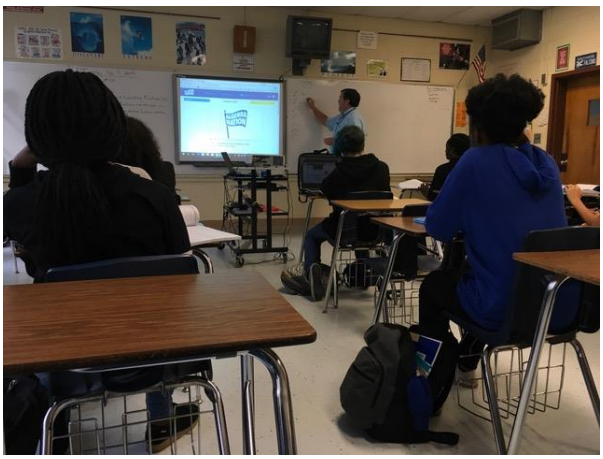
The teachers were concerned that the Algebra 1 End-of-Course test results may not document the gains their students have made so far this year. They pointed out that many students came from middle school setting at which they did not have a math teacher and missed key concepts. The teacher expressed the need to address students' learning needs, which may not match material tested. She pointed out that students were much more positive and enthused about learning math.

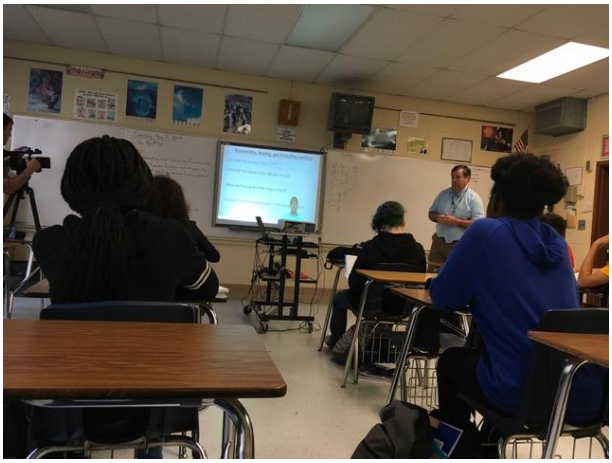
Algebra Nation School Visit and Observation

Southside Middle School
Florence County School District 1
Mr. Scott Carter
8th Grade Algebra 1

Mr. Carter had planned a demonstration lesson. Three news reporters from local media were in the room with two cameras filming. There were 17 students in the class.

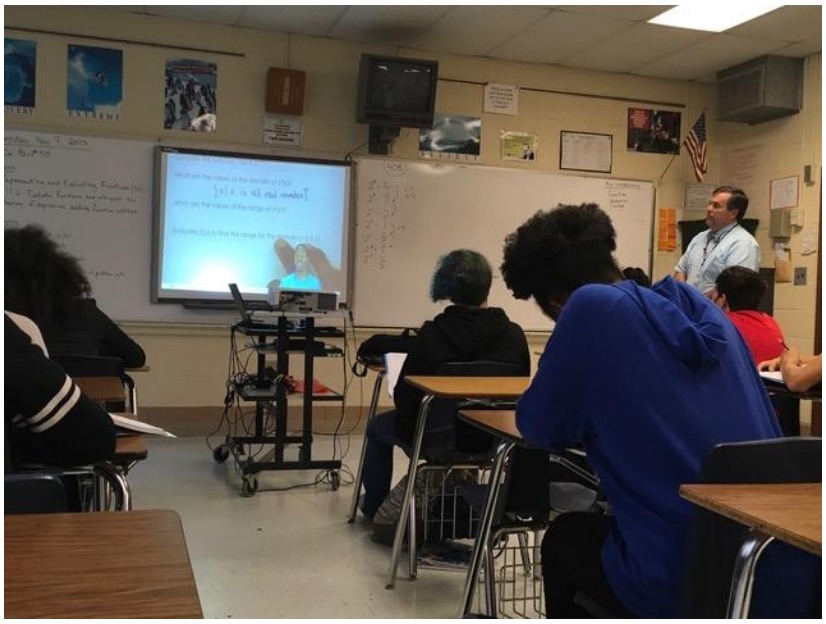
Mr. Carter introduced the lesson that addressed representing, naming and evaluating functions and the use of **Algebra Nation** materials. He used the white board to demonstrate patterns of powers of 2 helping students see the result from a negative exponent. He had anticipated the introduction of negative exponents on the video and wanted to ensure understanding of this new concept. Mr. Carter alluded to the favorite video tutor that students might have and indicated that he had selected Darnell because of how Darnell explains this concept.



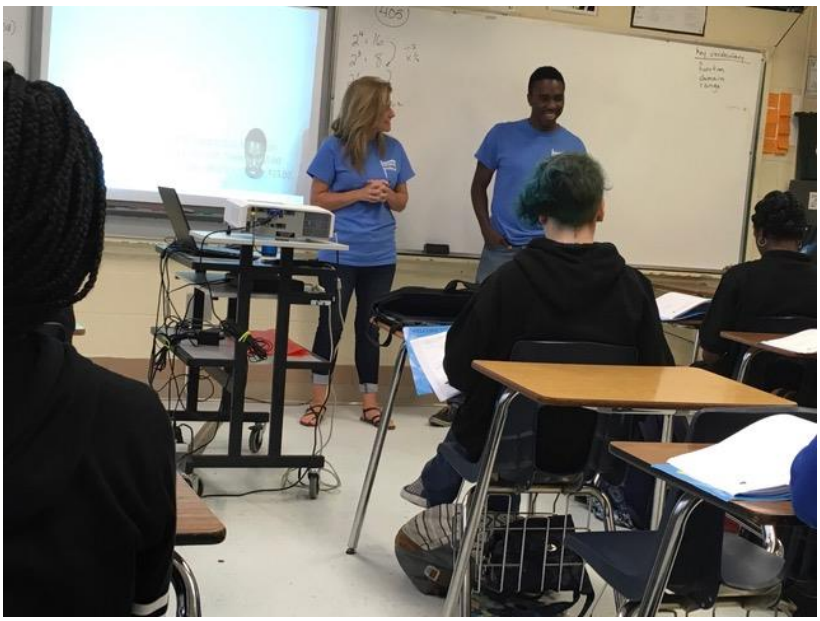


Students attended to the tutor on the video and took notes. Mr. Carter interjected clarifications and paused the video to ask questions and hear student responses. At one point Mr. Carter paused the video and had students write out their own solution on their papers then check the result using the video.

The video used a word problem and Mr. Carter pointed out that this was the type of problem the students find to be difficult. Darnell on the video worked through an example with donuts then worked backwards given the amount spent. Mr. Carter would interject over the video with clarifications. He paused the video and asked students to complete the exercises in the **Algebra Nation** workbook similar to what was on the video. Students were told to finish the work as part of homework.



As part of a planned **Algebra Nation** school visit, Darnell came into the class for a visit along another video tutor, Amy Adams. Students were excited to see the video tutors and expressed what they liked about **Algebra Nation**: the different tutors and the pacing each one uses (some slowly with details, some more quickly for review). Some students are using the Wall and said the Wall helped. They get help from students across the state and some provide help on the Wall. Amy suggested using the Test Yourself Practice tool. Students indicated they use the workbook every day.



Algebra 1 Observation for Algebra Nation (AN)

Tom Mauldin
Cheraw High School
8 November 2017

9:30 - 10:00 a.m. second block Algebra 1 class

Cheraw High is located in Chesterfield County and is the only high school for the Cheraw attendance area. The school enrolls approximately 700 students with the racial make up at about 50/50 (African American/White). The school does not enroll enough Hispanics to make the minimum N count of 20 for state testing. The school's poverty rating is approximately 70%.

A large contingency of people were on hand to visit the class including the principal, superintendent, local member of the House of Representatives, assistant superintendent for instruction, director of CATE, director of IT, director of secondary education, and the lobbyist for Algebra Nation. Present from Algebra Nation were Amy and Darnell.

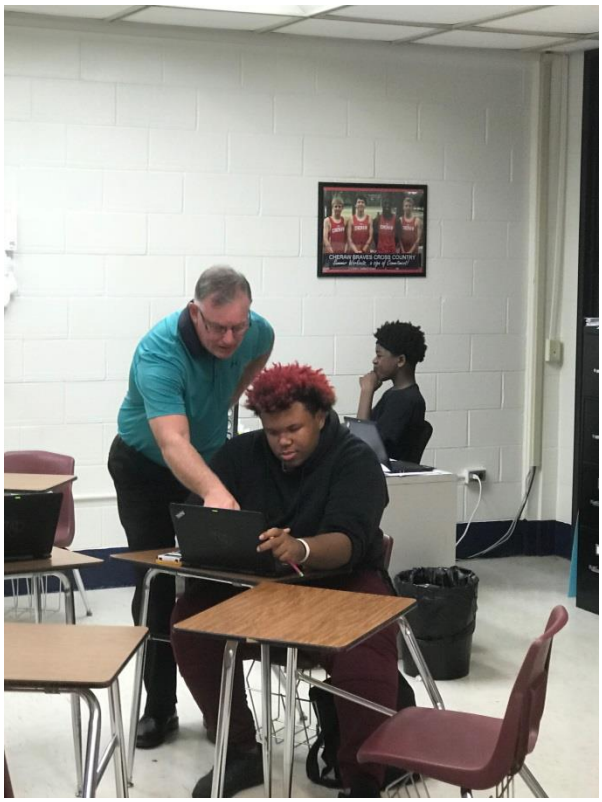
The teacher, Tom Mauldin, is an experienced teacher with 33 years of experience. Thirty-one of these years were in North Carolina and the last two years he has been at Cheraw High. He commutes from North Carolina, which is approximately a 20-mile drive. He was certified originally in North Carolina through the traditional teacher certification program.

Mr. Mauldin teaches 80 Algebra 1 students in six classes per day. The class I observed had 12 students with mixed abilities. Three students were special education students and two students might be better served in honors Algebra 1 (as reported by the teacher). The student make up was nine African American and three White. There were five females and seven male students.

Mr. Mauldin was praised by his principal and superintendent as an excellent teacher. I observed his ability to communicate well with the students and the positive relationship with the students. He very engaged with each group of students and was respectful of their questions.

The class began with the teacher taking up homework as part of the exit ticket from yesterday's class. Students were directed to the white board with directions to begin in AN Section 2 Equations and Inequalities. Students were to complete the Test Yourself section in Algebra Nation.

The teacher reminded the students that as they answered the questions, the program would place a "check mark" beside each question. The "check mark" did not mean the answer was correct, only that the student had answered the question. He further explained that the program would provide assistance to the student if they missed the question. Students were working out problems on scratch paper. The students spent the next 20 minutes completing the Test Yourself section.



Students were in small groups with desks in a circle. The teacher reported that he liked having students in small groups in which students were placed by ability levels. He was able to provide greater assiatnce in this way and he found students were more willing to assist each other in this small group arrangement.

There no Internet issues on the day of the observations but the teacher reported occasionally, especially in the afternoon there were accessibility issues. (One student could not log on and the teacher sent the student to the teacher computer and the student was able to log on.)

Interestingly, Algebra Nation had only been fully functional for about a month. The school had recently purchased a set of 30 Chrome books for the entire school! Mr. Mauldin had access to them for the next two weeks, as the Chrome book would be rotated to other classes. I was not able to discern when he would get this set returned for student use. In light of this, Mr. Mauldin had purchased 10 Chrome book with his own funds so his students would have access when the school's set of Chrome books were not available.

The Algebra Nation folks present used the remaining class time to have a question and answer session with the teacher, students and visitors. One student stated she liked AN because it allowed her to move along at her own pace and be challenged. (The teacher noted to me that this student needed acceleration and her father had already spoken with the teacher about the student being bored.)

Another student indicated that the Test Yourself section was very hard but with the solution videos he is beginning to feel better about his ability in algebra.

Another student asked if she could use the program over the summer since she tends to forget what she has learned the previous year. AN staff indicated that would be available and AN would have to work out the details with the district staff.

Overall, the superintendent, principal and teacher were very supportive of the AN program. They all felt the AN staff members were very supportive to the school needs and to the teacher. They indicated that AN was willing to come on site to work out any issues the school/teacher may be experiencing.

The teacher further stated that he liked AN because it allowed for differentiating instruction for students who needed remediation as well as for students who needed to be challenged. The teacher felt the greatest challenge was getting students to "buy in" to AN. He stated there were wonderful resources for students to access on their own at home but all students had not taken advantage of it. He started assigning homework on AN but had pulled back because parent complaints (most probably the issue of internet access). It is noted only four students did not have Internet access at home. The teacher allows students to check out his personal Chrome Books in order for them to have access and take way the excuses. To date, no student has taken him up on his offer.

AN staff noted that AN is available on all devices such as phone, tablets and computers and has recently upgraded its app to allow students to download AN lessons for use at home, on the bus, etc.

The teacher is working to find ways to encourage students to but in to AN. He is giving extra credit for students that post or answer a question on the Algebra Wall. He says that word is getting around quickly with the students and he is seeing more of them take advantage of it.

Teacher also allows students to retest in AN and take the greater test score.

During discussions with the superintendent, principal and teacher, they indicated they see other uses of AN such as when a teacher is absent, when a long-term substitute is in a class as well as when a teacher needs support in some of the algebra content.

There was lots of discussion among the district and school administrators along with the Hose member regarding Internet access in the school and funds for 1:1 device for students.

MCOP^2 Form for Tom Mauldin

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description
3		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
0		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments: 3 – all students engaged + on task; however, tasks were low level.

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description
3		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
2		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1		The students manipulated or generated one representation of a concept.
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments: NA

3) Students were engaged in mathematical activities.

SE		Description
3		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments: 3 – all students engaged.

4) Students critically assessed mathematical strategies.

SE	TF	Description
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments: NA

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE		Description
3		Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
2		Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1		Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0		Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments
2 - Students were working on problems to answer the AN Practice Test question

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

	TF	Description
	3	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
	0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments
NA

7) The lesson promoted modeling with mathematics.

	TF	Description
	3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
	2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
	1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
	0	The lesson does not include any modeling with mathematics.

Comments
NA

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
3	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: NA

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; **or** more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; **or** a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: Noticed a couple of students use different strategies to solve problem on AN.

10) The lesson promoted precision of mathematical language.

TF	Description
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: NA

11) The teacher's talk encouraged student thinking.

TF	Description
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis***: examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis**: requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.
2	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments: T. talk was more giving direction

12) There were a high proportion of students talking related to mathematics.

SE	Description
3	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: NA

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description	Comments
3	3	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.	3 - high levels of respect in classroom
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.	
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.	
0	0	No students shared ideas.	

14) In general, the teacher provided wait-time.

SE	Description	Comments
3	The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	NA
2	The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
1	The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
0	The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE	Description	Comments
3	**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.	2 - students spent time discussing problems w/one another
2	**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.	
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.	
0	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.	

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

TF	Description	Comments
3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.	2 - teacher discussed problems w/ students on an as-needed basis
2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.	
1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.	
0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.	

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

Algebra 1 Observation for Algebra Nation

Wendy Major
Greenwood High School
January 11, 2018

1:50 to 3:20 pm 4th Block Algebra 1 Honors class

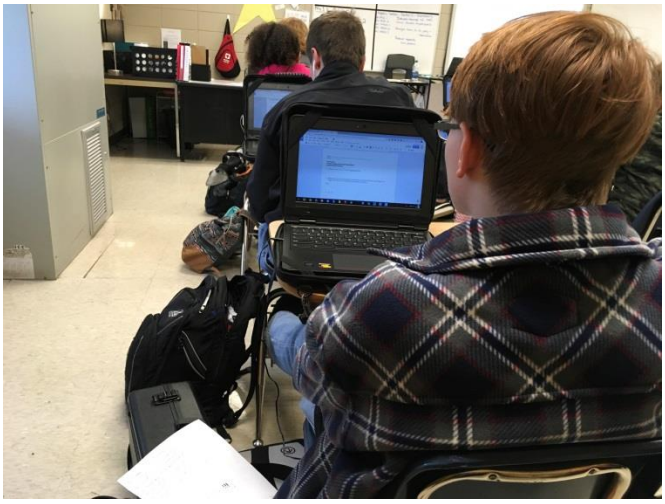
Wendy Major teaches semester long algebra courses and makes active use of Algebra Nation. This was the fifth day of the new semester in her Algebra 1 Honors course. After the bell rang she took roll silently then asked students to take out paper for notes and oriented students to using the Algebra Nation workbook. She wondered aloud about the order of the topics in the workbook but informed students that she planned to organize the course sequence consistent with the workbook sequence.

Ms. Major oriented the students to what would happen in class. First she returned a quiz she had created and reviewed the students' performance with them. She announced that the class would be assigned section 1 topic 2 from Algebra Nation for individual and group work after the quiz.

Students silently and individually reviewed what was missed on the quiz and were asked to check with friend or Ms. Major on what might be needed to help them understand what they got wrong on the quiz. There will be graded work later to check on understanding.

There were no questions so students were asked to get out their Chromebooks and access Google Classroom. Students had received instruction from Ms. Major and from Algebra Nation videos. They had 10 minutes to work on the prepared sheet individually to demonstrate understanding. Students were allowed to use earbuds for music as they worked in this assignment. Students

seemed familiar with the process and were all on task. Independent Practice from the Algebra Nation web site was the source of the student worksheet.



Ms. Major had noticed that the Word document was not using the equation editor to display algebraic expressions. Students helped find a way to get equations to show by opening the document in a new window. Ms. Major also expressed concern about having the Instructional Practice problems with copy and paste option from Word.

The mathematical content of the practice work addressed terminology like standard form, and naming type of polynomials (e.g., binomial, trinomial) requiring students to apply these terms. After 10 minutes of individual work students were allowed to work in small groups to compare answers. Some students continued to work alone and Ms. Major indicated that the choice to work in groups was theirs to make. About two-thirds of the class worked in groups, mostly in pairs. All students were on task. Ms. Major encouraged students to stay on task and complete the practice sheet. As they finished she collected the completed papers. At 2:45 she collected all papers and asked students to return to seats and put away Chromebooks

Students were instructed to write in their paper notebooks. She told them to write numbers 1 to 85. She brought the students' attention to her in the front. She explained she expected parent signatures by each number on this sheet over the semester. Students are to tell parents to sign verifying that the standards have been addressed. Ms. Major will send out emails to parents explaining what is expected of them.

Students were asked to get out the Algebra Nation workbooks and begin work on the section addressing the distributive property. Ms. Major expressed skepticism about the approach used by Algebra Nation, the block method, but said she wanted to try it. The class will watch the video with the Algebra Nation instructor, Amy, teaching the lesson as a group. Class was interrupted briefly for candy distribution for a school contest.

In the past students had used Algebra Nation videoes individually choosing their own tutor. This is the first time watching as a group.

Ms. Major showed what she believed was the method students had already used: FOIL. She then demonstrated how to distribute each term of the binomial to the other binomial. She tied this to what she called CLT, combining like terms that they had learned previously. She returned to the video to allow Amy to complete the explanation. As class ended she assigned Algebra Nation practice work on the distributive property.

Because the lesson was at the very beginning of the semester, the emphasis was on terminology so little emphasis on problem solving or applications were made. Ms. Major was expert at classroom management and it was clear that behavioral expectations had been established. The students were very respectful and eager to participate. There was clearly a very positive rapport been the teacher and her students. Ms. Major also managed the instructional transitions expertly moving fluidly between lesson components informing and orienting students throughout the lesson. The Algebra Nation material from the website, workbook, and videos served her instructional needs well.

MCOP^2 Form for Wendy Major

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description
3		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
(0)		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments: intro lesson

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description
3		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
(2)		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1		The students manipulated or generated one representation of a concept.
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments: "Model" for distributive as area

3) Students were engaged in mathematical activities.

SE		Description
(3)		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments: All students attended to the teacher led work on meaning of algebraic terms.

4) Students critically assessed mathematical strategies.

SE	TF		Description
(3)	3		More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2		At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1		An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0		Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments: Nearly all worked in pairs or groups on practice after individual work

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE	Description
3	Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
2	Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1	Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
(0)	Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

Problem solving not part of planned lesson

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

TF	Description
(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

Addressed state standards about terminology & properties

7) The lesson promoted modeling with mathematics.

TF	Description
3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); **or** modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
(1)	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
0	The lesson does not include any modeling with mathematics.

Comments

Area model for distributing property

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

	TF	Description
	(3)	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
	2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
	1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
	0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: Structure of distributive property addressed

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

	TF	Description
	(3)	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
	2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; **or** more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
	1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; **or** a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
	0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: The teacher was careful to consider past knowledge of the dist properly (FOIL) & new knowledge (Block)

10) The lesson promoted precision of mathematical language.

	TF	Description
	(3)	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
	2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
	1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
	0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: Teacher was very careful with terms

11) The teacher's talk encouraged student thinking.

	TF	Description
	3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis :*** examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis**: requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.
	(2)	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills
	1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
	0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments: The nature of the introductory lesson did not lend itself to high levels.

12) There were a high proportion of students talking related to mathematics.

SE		Description
(3)		More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2		More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1		Less than half of the students were talking related to the mathematics of the lesson.
0		No students talked related to the mathematics of the lesson.

Comments: All students talked at some point.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description
(3)	(3)	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.
0	0	No students shared ideas.

Comments: All students shared, questioned, commented.

14) In general, the teacher provided wait-time.

SE		Description
(3)		The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
2		The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
1		The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
0		The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.

Comments:

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE		Description
(3)		**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
2		**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.
1		The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
0		No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

Comments:

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

	TF	Description
	3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.
	(2)	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.
	1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
	0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.

Comments:

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

Algebra 1 Observation for Algebra Nation

Russell Saunders
Midland Valley High School
February 12, 2018

11:55 am to 12:45 pm Algebra 1 Lab class

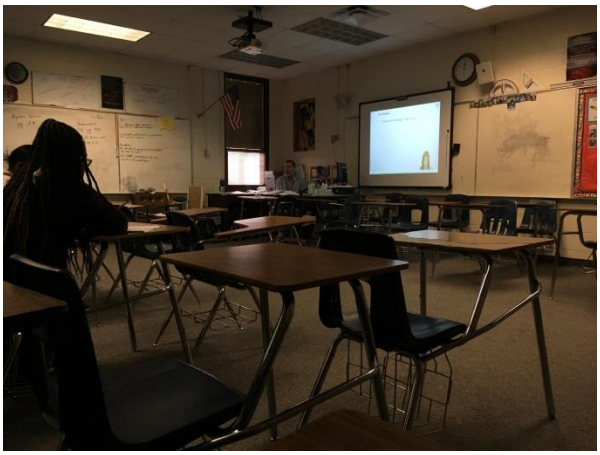
Russell Saunders teaches a lab class for students who are struggling with algebra. All students have access to Algebra Nation workbooks. As they entered class after lunch they picked up their workbooks and took their seats.

After the bell rang Mr. Saunders asked students to turn to page 126 in their workbooks where they had left off from the previous class. He reminded students that they had been working on factoring quadratic expressions and were now beginning to use factoring to solve equations.

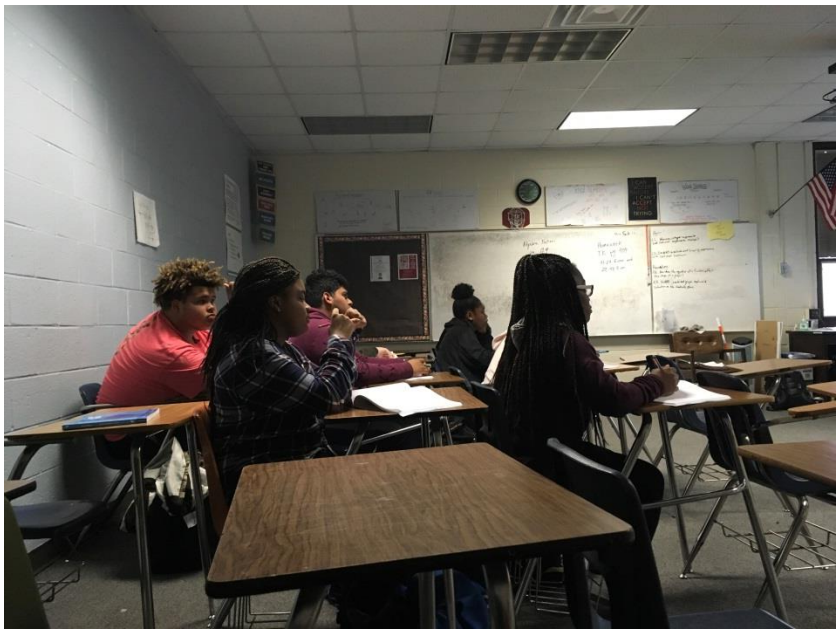
A video with Algebra Nation tutor Amy was shown introducing the concept and method for solving

$$b^2 + 8b + 15 = 0$$

Mr. Saunders demonstrated the area model for factoring the quadratic as used in the video and stated that he found this to be the best way to factor the quadratic. He demonstrated the area model method on the interactive white board while students took notes on their workbooks.



After his demonstration, Mr. Saunders returned to the video with Amy explaining how to use the zero product property to find the two solutions. He paused the video and reiterated the explanation given on the video. Students were paying attention to both Mr. Saunders' explanations and the video instruction. Mr. Saunders added what the number of solutions for this equation was 2 and sometimes there are no solutions or just 1.



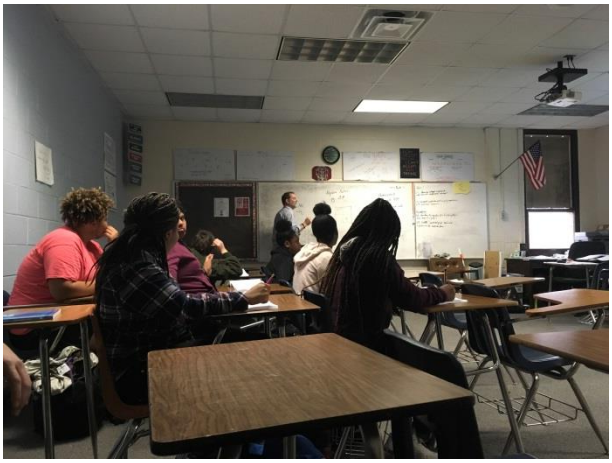
He allowed the video to show a second example for solving by the same method:

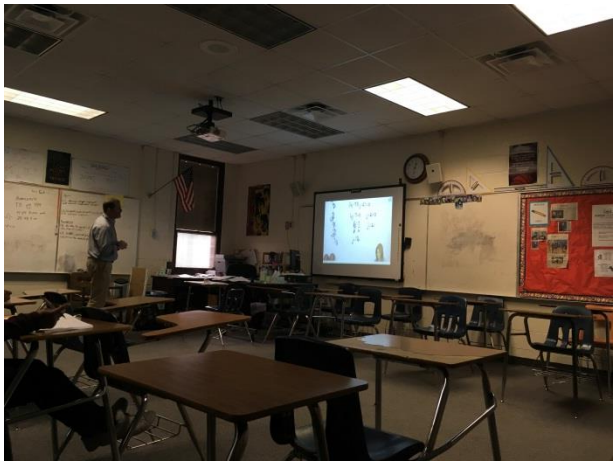
$$10f^2 + 17f + 3 = 0$$

After Amy began the second example Mr. Saunders paused the video and explained the solution method in his words allowing students to ask questions. He paused and asked students to provide the solution values that would come next in the video. He explained how they are moving to the next step that takes the factored expression and uses the zero product property to find solutions. The example included fractions. A student asked how the 5 ended up in the denominator and Mr. Saunders explained at the board.

An example for students to try on their own was given: $6j^2 - 19j + 14 = 0$

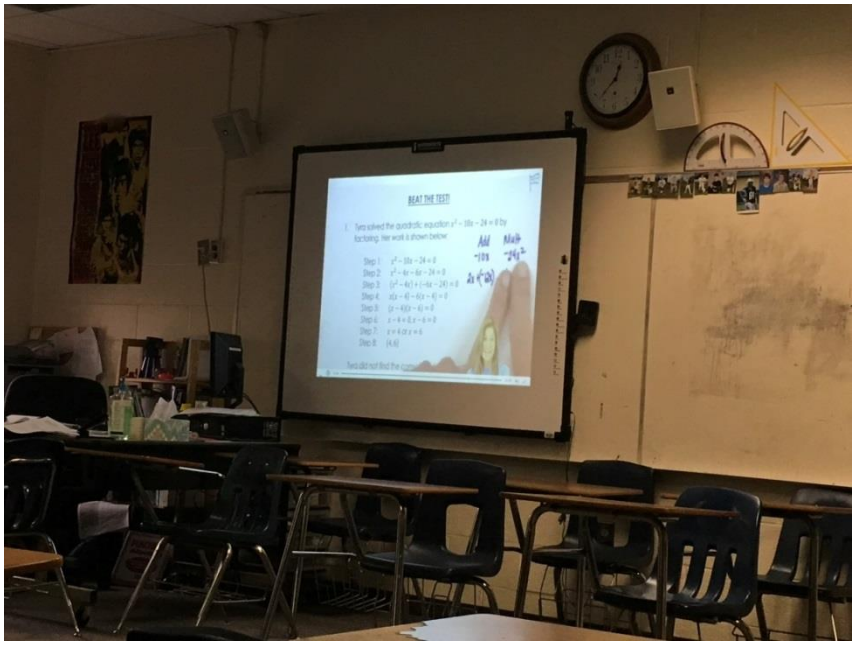
Mr. Saunders worked the third example on the whiteboard as the student did the same work on their workbooks. He provided calculators to find 6 times 14 because the factoring result had to add to -19. He guided students to reasoning why both factors were negative. They listed all the factors of 84 to find which added to -19 reaching -7 and -12 after trying several values. He pointed out the need to persevere to find the factors. He used questioning to work with the students to arrive at the factors for them to find the two solutions.





Mr. Saunders used the fast forward feature of the video to move to the point where he had left off from his explanation at the board and then showed the final solutions set using Amy's explanation.

The video next showed a ***Beat the Test*** example that had an equation solved in 8 steps. Mr. Saunders challenged the students to find the step with a mistake. They found the mistake and Mr. Saunders praised their work. He played the video to show the explanation, the solution, and the mistakes.



As Amy arrived at the two final equations, Mr. Saunders paused and asked the class to work to find the two solutions, which they did. He called on Trinity who didn't find the solution but Charity found one and Persa found the other.

The video mentioned the importance of checking solutions and to use this strategy when taking "important test." Mr. Saunders reiterated the point made on the video.

He summarized the lesson and the goal for the day. Students returned their calculators and workbooks as the classes ended.

Mr. Saunders made effective use of the video tutor and interjected his own explanations. Students benefited from the instructional approach using the perspectives of two teachers (Mr. Saunders and Amy). Mr. Saunders indicated that he selected Amy's instruction because he found her pacing best fit the needs of her students and he felt her handwriting was easier for students to read. He indicated that students on their own prefer to have Darnell as the tutor. He felt other tutors pace the lesson too quickly or their explanations aren't as clear as those of Amy and Darnell. He appreciates having the workbooks as they allow students to keep track of their progress. He also makes us of the Test Yourself and On Ramp features citing that On Ramp has helped him identify students' weaknesses or the gaps in their mathematics learning.

MCOP^2 Form for Russell Saunders

Russell Saunders Midland Valley HS 12 Feb 2018

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE	Description	Comments
3	Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.	Students investigated finding factors
2	Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.	
(1)	Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.	
0	Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.	

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE	Description	Comments
3	The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.	Symbolic factoring and area model used.
(2)	The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.	
1	The students manipulated or generated one representation of a concept.	
0	There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.	

3) Students were engaged in mathematical activities.

SE	Description	Comments
(3)	Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)	Students interacted with teacher
2	Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.	
1	Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.	
0	Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical -- such as a coloring activity.	

4) Students critically assessed mathematical strategies.

SE	TF	Description	Comments
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	
(1)	(1)	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.	
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.	

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE		Description
3		Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
(2)		Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1		Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0		Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

When confronted with find factors of 84 students persevered & used calculators to find factors

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

	TF	Description
	(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
	0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

Teacher worked to build conceptual understanding of equation solving through area model.

7) The lesson promoted modeling with mathematics.

	TF	Description
	3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
	2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); **or** modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
	1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
	(0)	The lesson does not include any modeling with mathematics.

Comments

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description	Comments
3	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.	
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.	
(1)	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.	
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.	

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description	Comments
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.	
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.	
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.	
(0)	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.	

10) The lesson promoted precision of mathematical language.

TF	Description	Comments
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.	
(2)	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.	
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.	
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.	

11) The teacher's talk encouraged student thinking.

TF	Description	Comments
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis*** : examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis:** requires original, creative thinking. **Evaluation:** makes a judgment of good or bad, right or wrong, according to the standards he/she values.	
(2)	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills	
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory:** recalls or memorizes information. **Translation:** changes information into a different symbolic form or situation.	
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.	

12) There were a high proportion of students talking related to mathematics.

SE	Description	Comments
3	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.	
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.	
(1)	Less than half of the students were talking related to the mathematics of the lesson.	
0	No students talked related to the mathematics of the lesson.	

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description	Comments
3	3	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.	
2	(2)	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.	
(1)	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.	
0	0	No students shared ideas.	

14) In general, the teacher provided wait-time.

SE		Description	Comments
(3)		The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
2		The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
1		The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
0		The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE		Description	Comments
3		**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.	
2		**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.	
1		The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.	
(0)		No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.	

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

	TF	Description	Comments
	3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.	
	(2)	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.	
	1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.	
	0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.	

Additional Notes: Preservice or inservice. Live or Video. #Students, Grade Level, Topic/Subject, date, other demographics, school, etc.

The lesson focused and using factoring to solve quadratic equations. Video instruction served to demonstrate the algebraic method of solution. Students viewed two examples, then tried one on their own but with the teacher working the example on the board

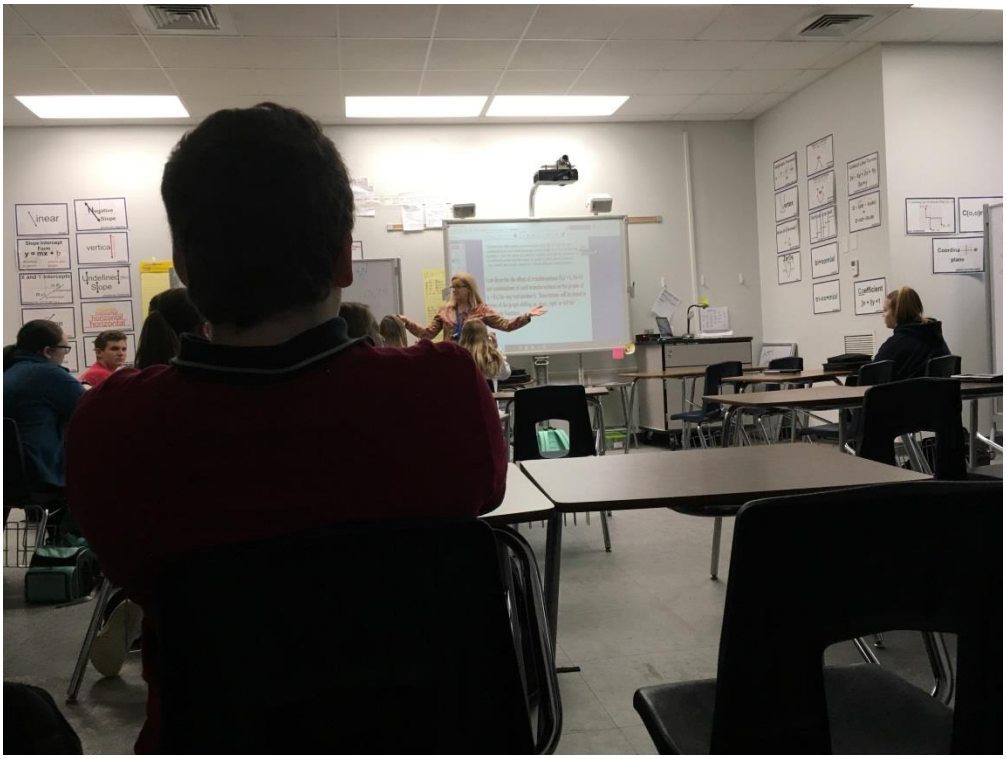
Algebra 1 Observation for Algebra Nation

Kathi Haynie
Belton Middle School
February 13, 2018

10:09 to 11:59 am Algebra 1 High

Kathi Haynie teaches several section of Algebra 1 to advanced middle school students. She is in her 29th year of teaching and expressed enthusiasm to the potential that Algebra Nation resources bring to her teaching. While her students have access to Algebra Nation workbooks, she prefers to create her own worksheets. Before class began, she expressed her concern that students watching the video often complete the workbook or worksheet pages without thinking about concept being learned. To address this, she has used segments of videos with "time-stops" for students to pause the video, complete the written work, and then have her check for understanding. A school assistant principal who was a former mathematics teacher was in the room for this class to observe and assist Ms. Haynie.

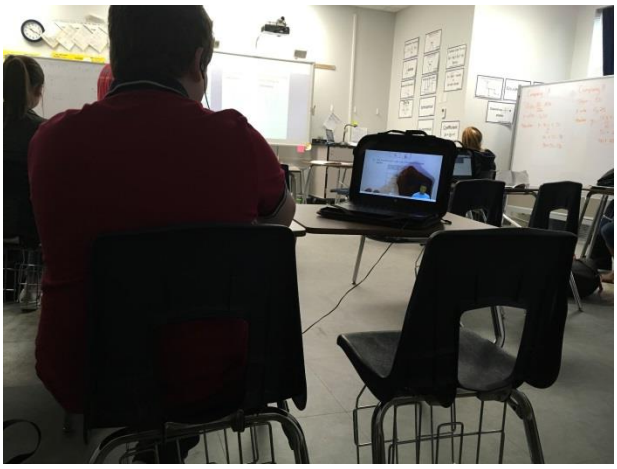
After the bell rang, Ms. Haynie brought students' attention to the standard addressed as part of the day's class that was projected on the interactive white board. She then asked for students in their own word to explain what a transformation means. She used discourse to bring in the word "shift" as into the definition then reviewed the direction of vertical and horizontal shifts based on the number added.



Ms. Haynie used questions and discussion to explain the effect of a transformation in terms of left/right or up/down shifts. This helped her explain that the day's lesson that was to include a combination of transformations. She provided a graphical example with g(x) and used the term dependent value to stress definitions of independent and dependent variables, another South Carolina standard expectation.

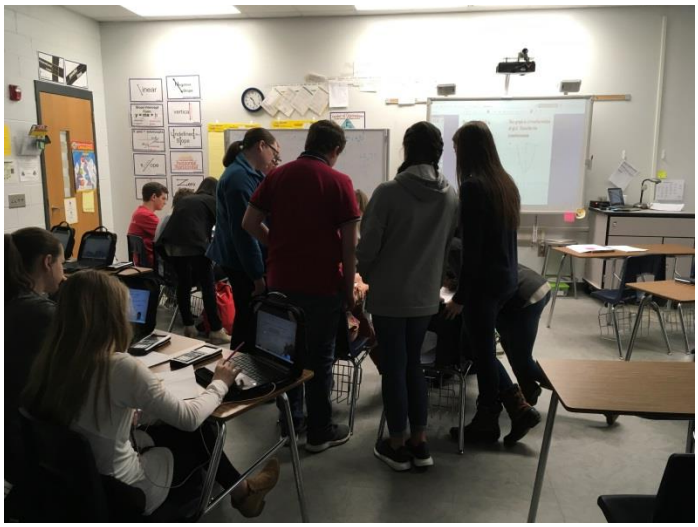
Ms. Haynie asked students to take out the worksheet they had used on the day before. Each student had a Chromebook and accessed Algebra Nation videos to support the work on the sheets. There was mention of two students (out of 24) having access problems in the last class, but there had been resolved. All students accessed the videos quickly with confidence and ease.

Most students had their own headphones but extra headphones were available and a few students used those. Ms. Haynie used time codes from the video as stop points to allow her to assess student understanding. Students would raise their hand when reaching the time code for stopping and after explaining their interpretation orally to the teacher, receive a check mark on the problem on the worksheet. The assistant principal helped assess and check students' work as well as Ms. Haynie.



The video lesson had Darnell explaining the table values of a function transformed by adding 2. Students were to do similar work, then have Ms. Haynie or the teaching assistant check their work.

When Ms. Haynie noticed a problem among several students interpreting how to find the shift from the video, Ms. Haynie brought 6 students together to explain the concept differently in what she called "mini-workshop." She explained the translation from the video using independent variable and shift. She supplemented the method used by Darnell that required equation solving to a method using the graphical representation of the shift. Students then had two interpretations: a symbolic and a graphic.



When the small group lesson was finished Ms. Haynie went back to checking the work of paired student groups ensuring that both students in the group understood the concept. Students were to show her the work they completed and explain in their own words so she was assured of understanding.

All students were on task throughout the lesson. They worked effectively in pairs. Ms. Haynie monitored progress carefully, and students were diligent about having worked checked before progressing to other problems. As the class ended, Ms. Haynie asked students who had not finished to so some for homework.

11:02-11:54 am

A second algebra 1 class came in and Ms. Haynie taught the same lesson again.

In this class, students worked independently in pairs for nearly the entire period allowing Ms. Haynie time to work with 2 students who were struggling with the concept. All students were on task whether working independently or with the teacher.

Ms. Haynie expressed to me that the use of the videos has increased the rigor of her teaching. Not only is she attending to different presentation methods, but she has also increased her use of formative assessment because the videos provide an instructional assistant allowing her time for assessment. She selected the videos with Darnell based on students' input. She prefers to write her own worksheets but will consider using the ones provided by Algebra Nation. She expressed concern for the inefficiency of checking each student for understanding, and we discuss strategies that delay the assessment until the end of a week or the unit as an alternative.

MCOP^2 Form for Kathi Haynie

Kathi Haynie Bolton Middle School 8th Grad Alg I 13 Feb 2018

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description
(3)		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
0		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments: Students investigated the effect of vertical & horizontal shifts on graphs: $f(x+k)$ $f(x)+k$

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description
(3)		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
2		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1		The students manipulated or generated one representation of a concept.
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments: Used symbolic & graphical representations.

3) Students were engaged in mathematical activities.

SE		Description
(3)		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments: All students were engaged throughout the lesson period.

4) Students critically assessed mathematical strategies.

SE	TF	Description
(3)	(3)	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments: The teacher expected each student to critically assess the strategy used & to explain orally the interpretation

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE	Description
(3)	Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
2	Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1	Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0	Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

All students persevered to apply the strategy. Struggling students received extra help and showed appreciation.

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

TF	Description
(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

The teacher directly addressed the standard and frequently referred to it.

7) The lesson promoted modeling with mathematics.

TF	Description
3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); **or** modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
(0)	The lesson does not include any modeling with mathematics.

Comments

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
(3)	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: The teacher emphasized the structure of the sign (+, or −) and how it effects the shift.

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
(2)	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: The symbolic and graphic representations were a secondary focus

10) The lesson promoted precision of mathematical language.

TF	Description
(3)	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: The teacher was very careful to use precise language

11) The teacher's talk encouraged student thinking.

TF	Description
(3)	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis :*** examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis:** requires original, creative thinking. **Evaluation:** makes a judgment of good or bad, right or wrong, according to the standards he/she values.
2	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation:** discovers relationships among facts, generalizations, definitions, values and skills. **Application:** requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation:** changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments: Students examined and interpreted patterns and were expected to verbalize their findings.

12) There were a high proportion of students talking related to mathematics.

SE	Description
(3)	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: Each student was expected to explain in own words to teacher.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description	Comments
(3)	(3)	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.	
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.	
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.	
0	0	No students shared ideas.	

14) In general, the teacher provided wait-time.

SE	Description	Comments
3	The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
(2)	The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
1	The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	
0	The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.	

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE	Description	Comments
(3)	**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.	Students worked in pairs throughout lesson
2	**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.	
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.	
0	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.	

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

TF	Description	Comments
(3)	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.	
2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.	
1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.	
0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.	

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

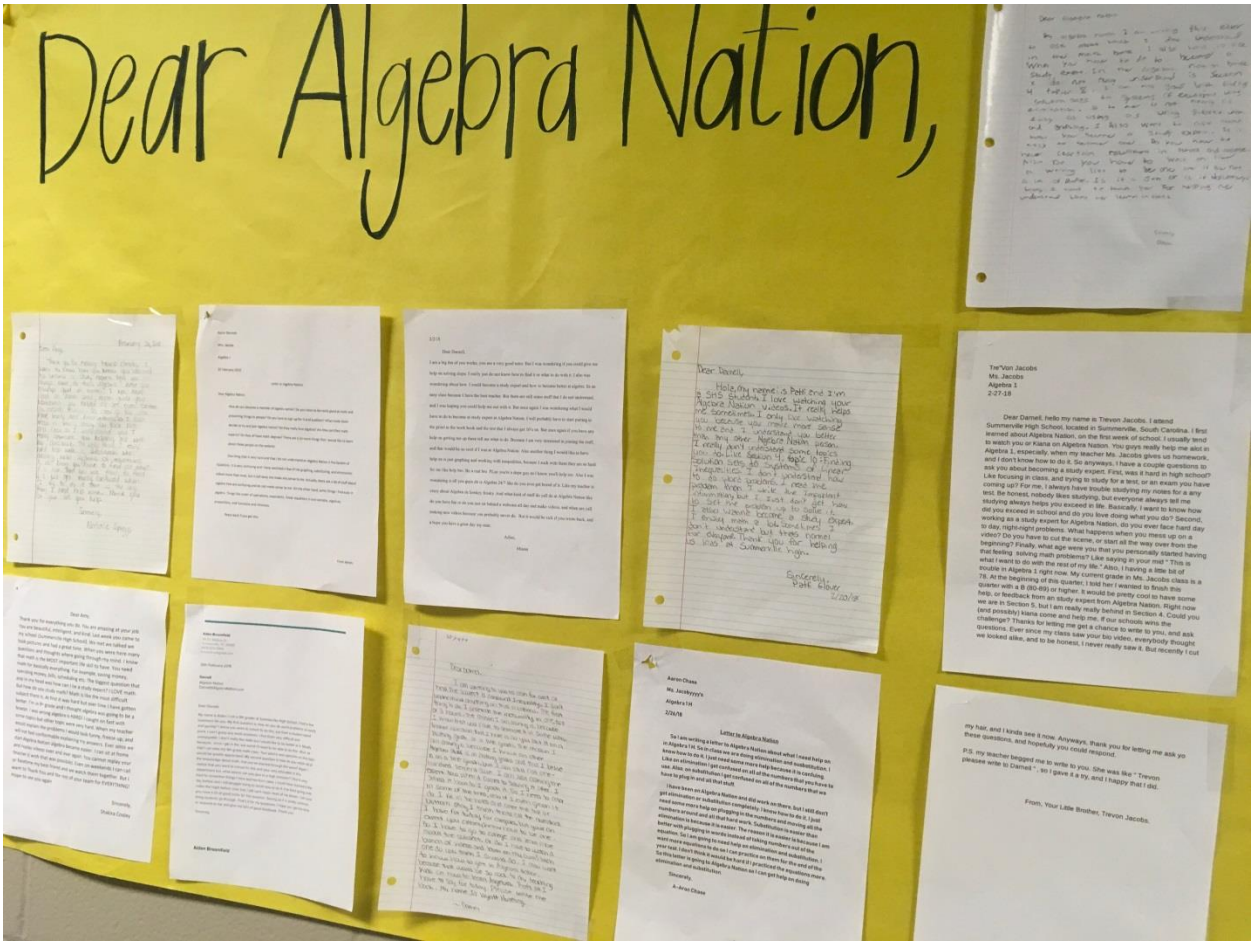
Ms. Haynie made effective use of the Algebra Nation video lesson segment using a portion of the video to address a symbolic solution method that she supplemented with a graphical method that she explained.

Algebra 1 Observation for Algebra Nation

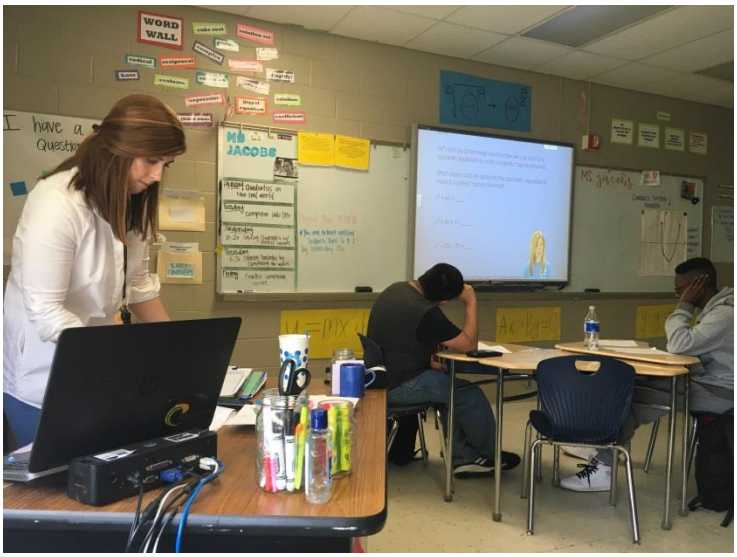
Ashley Jacobs
Summerville High School
March 1, 2018

10:46 to 11:32 am Algebra 1 CP

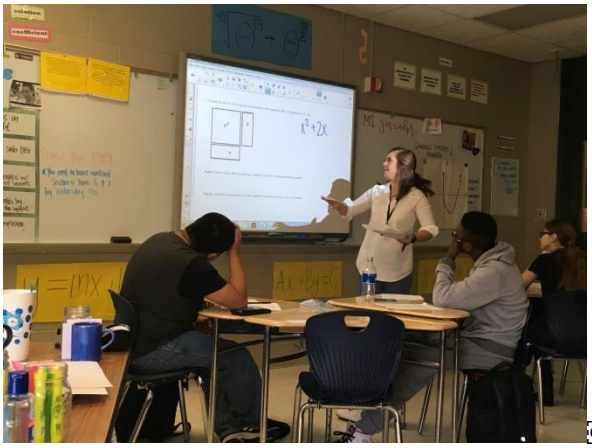
Outside of Ms. Jacobs' room were letters to the Algebra Nation tutors. Tutors Amy and Darnell had visited in the recent past and students enjoyed connecting with the math instructors who they experience via the videos.

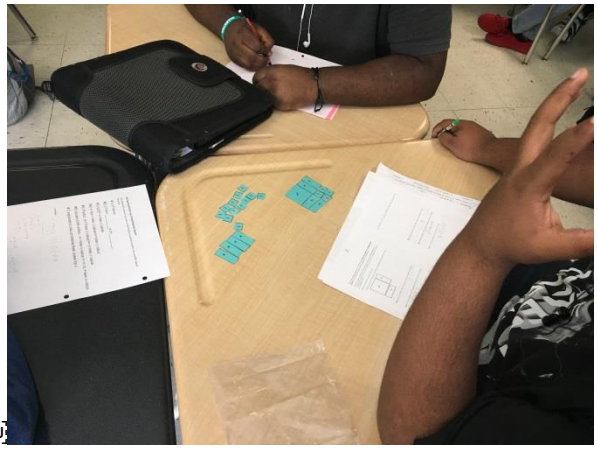


As students entered there were instructions on the board about a warm up and reference to the Algebra Nation worksheet that had been printed for each student of the 23 students in this class. Student desks were arranged in groups of 3 or 4 and students were accustomed to working together. When the bell rang Ms. Jacobs reminded students of the day's topic. She let them know the goal of the day's lesson about completing the square. She asked students to view an Algebra Nation video of Amy teaching the topic while she took roll.



Students had met video tutor Amy earlier and were excited to have her video lesson. The video lesson reviewed how to find the constant value to add to a quadratic that makes it a perfect square when factored. This involved remembering half the coefficient of *x* squared. She next had the students work in groups to use algebra tiles to model the process linking it to area.

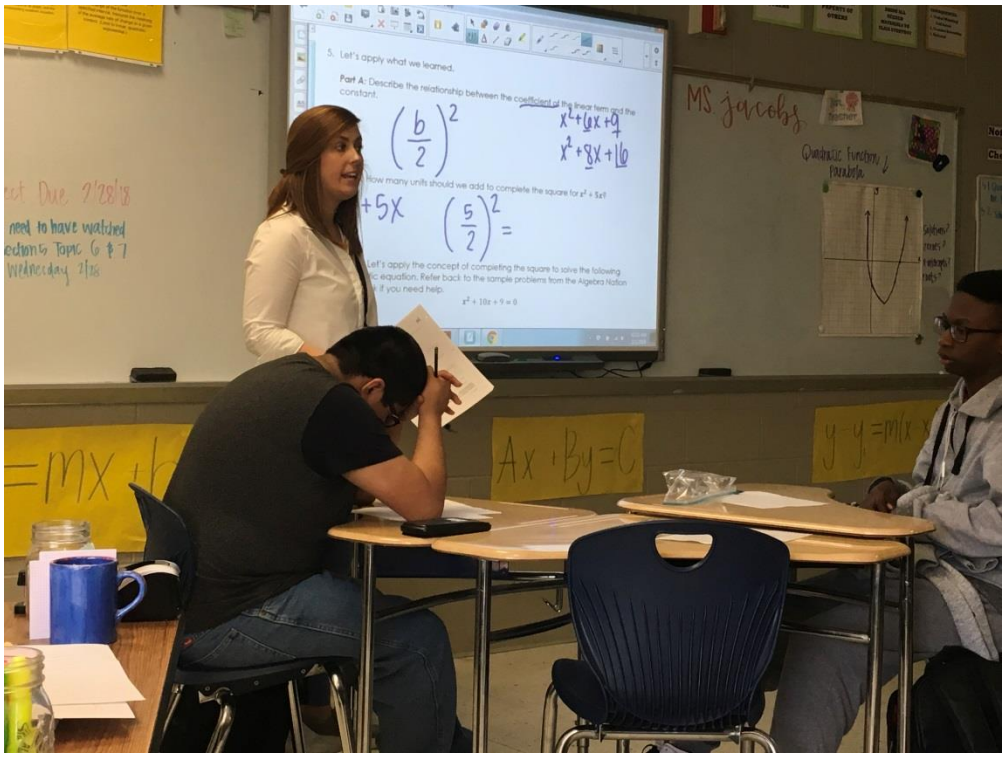




The example she did as a demonstration involved $x^2 + 2x + ?$ She used a worksheet from Algebra Nation. She next assigned the student groups to work in a second example.

Ms. Jacobs noticed some groups making errors with the tiles and helped correct the misconception. She called on members of groups to write the answer to the worksheet problem on the board. There were two more examples to be worked. All examples had an even number of *x*'s to ensure the perfect square had an area model without fractions

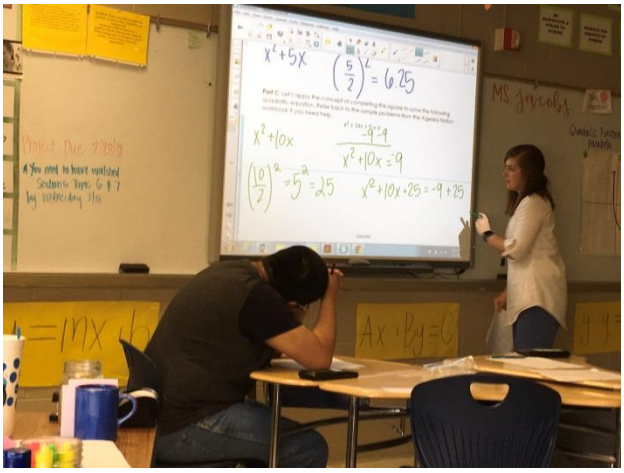
Part B of the worksheet included $x^2 + 5x + ?$ That extended the concrete example to one that is more abstract.

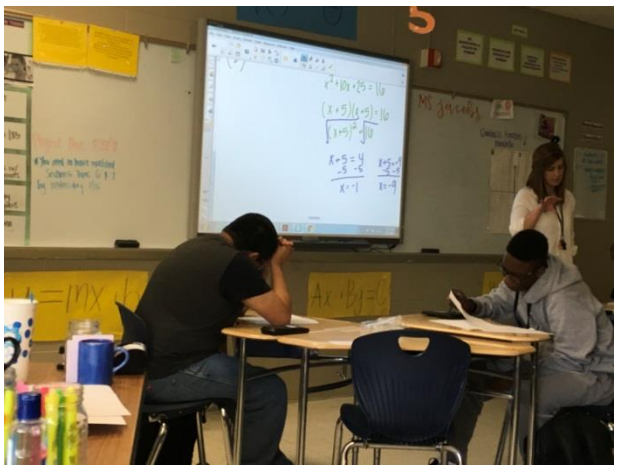


Students used calculators to square 5/2 instead of staying with fractions. Ms. Jacobs pointed out that modeling this with tiles would require cutting tiles, which she did not want to do.

The final example for Part C foreshadowed equation solving.

Ms. Jacobs continued the example to demonstrate how the completed square solves the equation. She explained how two solutions are the result.



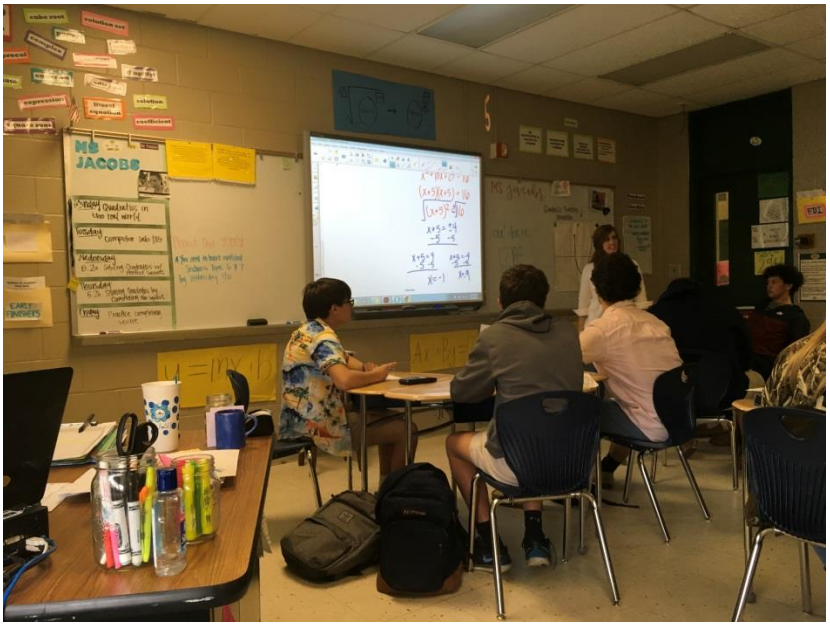


Student groups were to work a similar example on the sheet. As the bell rang the video was assigned as help for the homework that required completing the problems on the sheet.

11:36 am -12:23 pm Algebra 1 High

The next period class entered the room and like the previous one and students were instructed to pick up the Algebra Nation worksheet that Ms. Jacobs had downloaded and printed. She repeated the earlier lesson for the 21 students making up this class.

For this class Ms. Jacobs used + or - to produce two solutions as she and I discussed between classes.



Summary:

Ms. Jacobs made use of video lessons and online worksheet to guide lesson. This allowed her to attend to student understanding while Amy was teaching. She had students watch the video to complete the sheet for homework. The Algebra Nation lesson helped her connect the abstract concept to an area model and to make use of formative assessment tools.

As a post observation discussion with the district mathematics supervisor, Ann Sanderson, we talked about the difference that Algebra Nation materials made to Ms. Jacobs teaching. Ms. Jacobs cited the online tutors helping students as well as the usefulness of the Test Yourself tools. Both explained that using the Algebra Nation materials had helped all the district high school math teacher to examine state standards more carefully and identify instruction that directly addressed the standards. Ms. Sanderson mentioned that the sequence of polynomials in the Algebra Nation workbook influenced the district changing the Algebra 1 pacing guide and that this changed was received as an improvement. Introducing polynomial terminology earlier, as done in the workbook allowed teachers to make a connection between the algebra of polynomials' and base 10 numbers learned in elementary school mathematics. Both Ms. Sanderson and Ms. Jacobs felt that use of the videos had expanded the districts' high school math teachers' instructional skills and ability to address state algebra standards.

Ashley Jacobs Summerville HS 1 March 2018

Mathematics Classroom Observation Protocol for Practices (MCOP²)

1) Students engaged in exploration/investigation/problem solving.

SE	Description
3	Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2	Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1	Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
0	Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments: Investigated completing the square algebraically and with algebra tiles.

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE	Description
3	The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
2	The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1	The students manipulated or generated one representation of a concept.
0	There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments: Symbolic & area model.

3) Students were engaged in mathematical activities.

SE	Description
3	Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2	Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1	Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0	Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments: Students engaged throughout lesson.

4) Students critically assessed mathematical strategies.

SE	TF	Description
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments: Nearly every student critically assesses strategies as part of group work.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE		Description
3		Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
(2)		Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1		Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0		Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

Some students would seek help from teacher instead of persisting or seeking input from peer group members

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

	TF	Description
	(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
	1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
	0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

Teacher made direct mention of standard and worked to build conceptual understanding through concrete model.

7) The lesson promoted modeling with mathematics.

	TF	Description
	3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
	2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
	1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
	(0)	The lesson does not include any modeling with mathematics.

Comments

Teacher focused on completing square concept. Later lesson address quadratic models

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
(3)	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: The expectation of using tile to "complete the square" required use of structure.

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
(3)	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: The tasks of area model represented led to algebraic solutions.

10) The lesson promoted precision of mathematical language.

TF	Description
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
(1)	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: There was a lack in precision on solving quadratics with two solutions explaining why $x^2 = 9 \Rightarrow x = \pm 3$

11) The teacher's talk encouraged student thinking.

TF	Description
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis*** *:* examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis:** requires original, creative thinking. **Evaluation:** makes a judgment of good or bad, right or wrong, according to the standards he/she values.
(2)	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application:** requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments:

12) There were a high proportion of students talking related to mathematics.

SE	Description
(3)	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: almost all student talked with teacher or peer.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description
(3)	(3)	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.
0	0	No students shared ideas.

Comments: Almost all shared but mostly within groups

14) In general, the teacher provided wait-time.

SE		Description
(3)		The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
2		The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
1		The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
0		The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.

Comments: While the class period was short, think time was provided

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE		Description
(3)		**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
2		**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.
1		The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
0		No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

Comments:

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

	TF	Description
	3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.
	(2)	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.
	1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
	0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.

Comments:

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

Observed two classes, one with 23 and other with 21 students. Algebra Nation videos and worksheet use throughout the lesson. Alg I CP and honors

Teacher focused primarily on algebraic symbol manipulation skills for completing the square but did make significant effort to build conceptual understanding through area model representation with algebra tiles.

Algebra 1 Observation for Algebra Nation

Sharon Gregory and Dana Jenkins
Midland Valley High School
March 14, 2018

9:54 to 10:00 am Sharon Gregory Homeroom

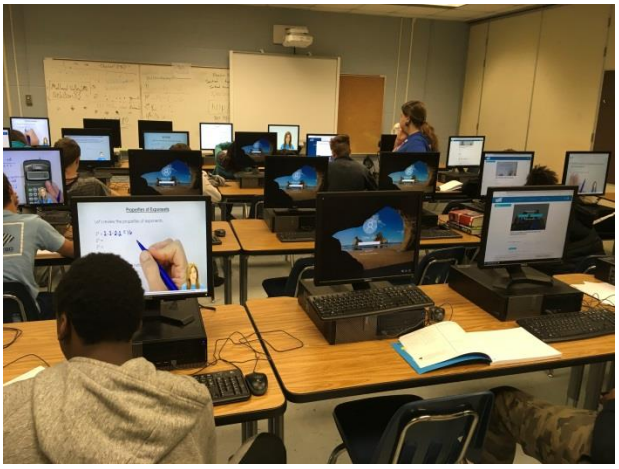
Because of an anticipated student walk out tied to the Stoneman Douglas school shooting one month earlier, the regular class schedule was delayed so that homeroom classes could meet to address the matter without student walkouts. Students in homeroom discussed and completed an online survey about attitudes.

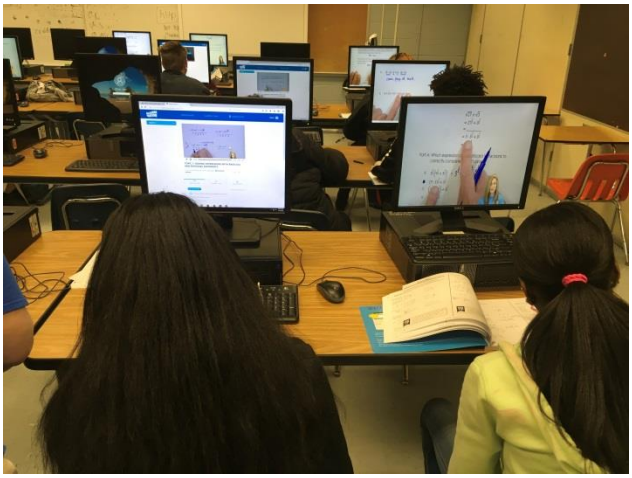
10:25 to 11:00 am Sharon Gregory Intermediate Algebra

The class was held in the school computer lab and included 19 students. Ms. Gregory scheduled the class in the computer lab to allow her students to access Algebra Nation resources and work on individual needs. She is able to schedule the lab for her class one every two weeks. She indicated that me that during regular class time she does not make use of Algebra Nation materials because she is not able to individualize assignments and does not see value in using the materials as part of group instruction. She regrets not having technology available for each student and offered to visit Ms. Jenkins' class that has computers for all in the room.

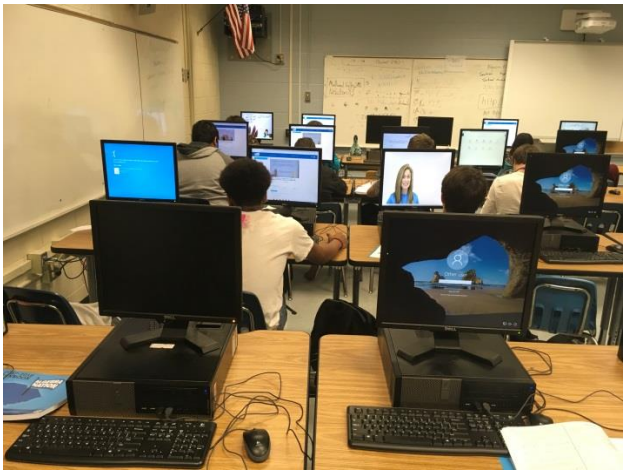
As students walked in, Ms. Gregory handed out Algebra Nation workbooks to each student. She asked students to log into the district portal. She encouraged them to use the Firefox browser and not Internet Explorer is the program had been locking up in the latter browser.

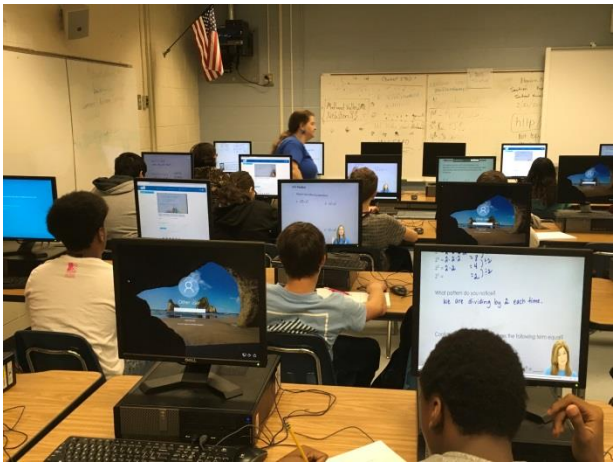
The login process took between 5 and 8 minutes. Students were instructed to go to sections where each had left off and use workbooks to monitor where they are. Ms. Gregory suggested using video tutor Amy for new material as she was the most thorough and perhaps another tutor if the material was already familiar. Some students had headphones, but those without used the volume at low volume.





Once she finished helping a few students who experienced log in problems, Ms. Gregory addressed those students with algebra content questions. Some raised the hands, and others were helped based on what she noticed from their screens and workbook writing. The class was working on Section 1 of the Workbook about algebraic expressions as well as radical numbers. Ms. Gregory explained that she is using this time to review concepts that student had seen in Foundations of Algebra the previous year.





All students were engaged with the Algebra Nation materials and on-task throughout the class period. Some seemed to be copying writing they saw on the video into the workbook while others seemed to be more thoughtful about what they were hearing and writing. Three students are English Language Learners but their command of English was sufficiently strong to allow them to use the English tutors and not Spanish.

Ms. Gregory indicated to me that she finds the Algebra Nation resources to be helpful but is frustrated with the limited access because of student technology access. She doubted that Algebra Nation use would have an impact on the end-of-course test scores for this class because of the limited use.

When the bell rang, students quickly logged out, returned their workbooks, and left the room.

11:05 to 11:20 am Dana Jenkins Study Hall

Ms. Jenkins teaches a study hall in which students can work on any academic course work from classes in which they are enrolled. About one-third were working on Algebra Nation.

Ms. Jenkins makes regular use of Algebra Nation for her two Algebra 1 CP classes taught during other times of the day. She indicated that she liked how using Algebra Nation videos with the workbooks helped students with what she called "note taking" which was writing into the workbook the algebra ideas explained on the videos. She has been making extensive use of the On Ramp and was eager to have all her student reach level 5. She felt the recently announced end-of-course test Boot Camp would be helpful in preparing students for the end-of-course test. She also indicated that the motivation to earn Karma Points through Wall postings was helping

students. Because a student at the school won a prize for the most Karma Points earlier in the year, other students seemed motivated to compete and win as well.

This is Ms. Jenkins' last week teaching before she takes maternity leave and she expressed her appreciation for having the Algebra Nation materials. She has prepared lesson plans for a substitute teacher is not qualified to teach mathematics but who will use the plans tied directly to Algebra Nation videos and other resources to all the students to continue to learn algebra over the remainder of the year. Ms. Jenkins was confident that the students will be successful without her.

MCOP^2 Form for Sharon Gregory

Sharon Gregory Intermediate Algebra Midland Valley HS

Mathematics Classroom Observation Protocol for Practices (MCOP^2) Mar 14, 2018

1) Students engaged in exploration/investigation/problem solving.

SE	Description	Comments
3	Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.	All students engaged with Alg. Nation instruction
2	Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.	
1	Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.	
0	Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.	

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE	Description	Comments
3	The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.	all symbolic
2	The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.	
1	The students manipulated or generated one representation of a concept.	
0	There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.	

3) Students were engaged in mathematical activities.

SE	Description	Comments
3	Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)	
2	Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.	
1	Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.	
0	Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.	

4) Students critically assessed mathematical strategies.

SE	TF	Description	Comments
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	Strategies presented on videos were not discussed
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.	
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.	
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.	

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE	Description	Comments
3	Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.	About half of students were reasoning & thinking instead of copying
(2)	Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.	
1	Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.	
0	Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.	

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

TF	Description	Comments
3	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.	
2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.	
(1)	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.	
0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.	

7) The lesson promoted modeling with mathematics.

TF	Description	Comments
3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).	
2	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.	
1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.	
(0)	The lesson does not include any modeling with mathematics.	

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
3	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
(0)	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments:

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
(2)	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; or more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; or a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: paths provided from videos

10) The lesson promoted precision of mathematical language.

TF	Description
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
(2)	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments:

11) The teacher's talk encouraged student thinking.

TF	Description
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis :*** examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis:** requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.
(2)	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments: Mostly from video tutors

12) There were a high proportion of students talking related to mathematics.

SE	Description
3	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
(1)	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: a few asked questions

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description
3	3	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.
(1)	(1)	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.
0	0	No students shared ideas.

Comments

14) In general, the teacher provided wait-time.

SE	Description
3	The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
2	The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
1	The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
(0)	The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.

Comments

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE	Description
3	**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
2	**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
(0)	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

Comments

all individual work on computers / with AN videos

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

TF	Description
3	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.
2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.
1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
(0)	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.

Comments

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

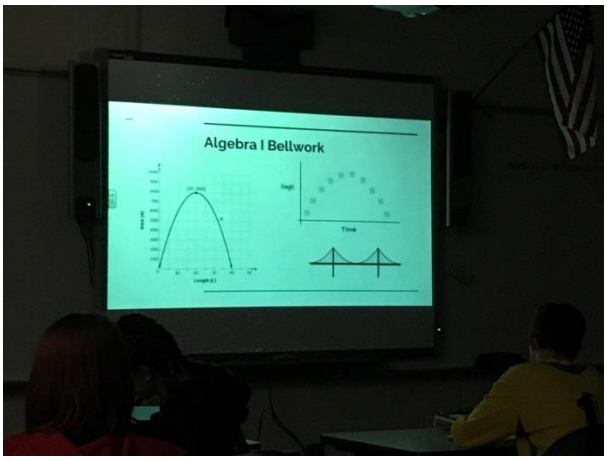
The purpose of this lesson was to reinforce knowledge & skills learned in a prior algebra course. The teacher was using the computer lab to review with individualized assignments. The class period was cut short by an unexpected schedule change.

Algebra 1 Observation for Algebra Nation

Jennifer Porter
E.L. Wright Middle School
March 28, 2018

9:48 to 10:53 a.m. Grade 7 Algebra 1

As students walk in there were instructions on the board. There were 13 students are in today's class with 3 missing because of band. When the bell rings Mrs. Porter reviewed the material on the board. They are assigned a video from Algebra Nation to watch for homework. She then asked students to share something good that is happening in their lives.

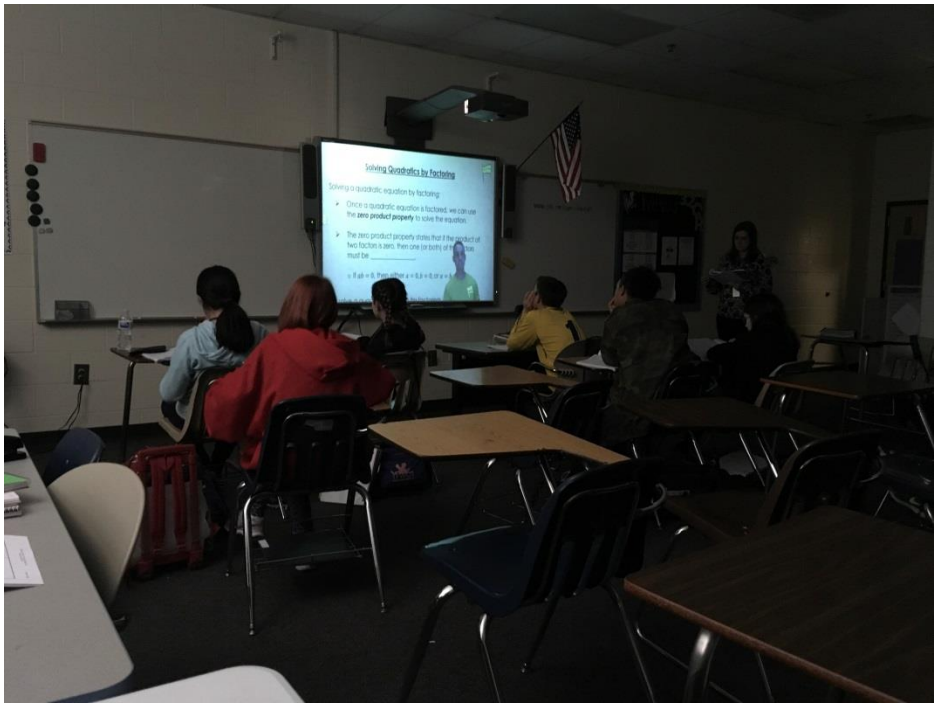


She projected three quadratic function graphs on board and asked students to write something about each in their notebooks.

Students spent about 3 minutes writing individually. Mrs. Porter stated her goal of connecting the graphs to what was learned in the Algebra Nation video watched. She drew from the students the reasons why they feel the graphs represents a parabola contrasting why the graphs are not linear and why the curves are parabolic. She emphasized precise vocabulary and also contrasted rate of change for linear versus quadratic functions with a student mentioning that linear functions have a constant rate of change.

Mrs. Porter introduced the process of finding solutions to quadratic equations using one of the graphs. She emphasized how some of the graphs represent real life situations such as a ball being tossed as an example. She stated that today's lesson goal is to take real world examples with equations and find solutions. She indicated that terms like solutions, zeroes, x-solutions, or roots have similar meanings.

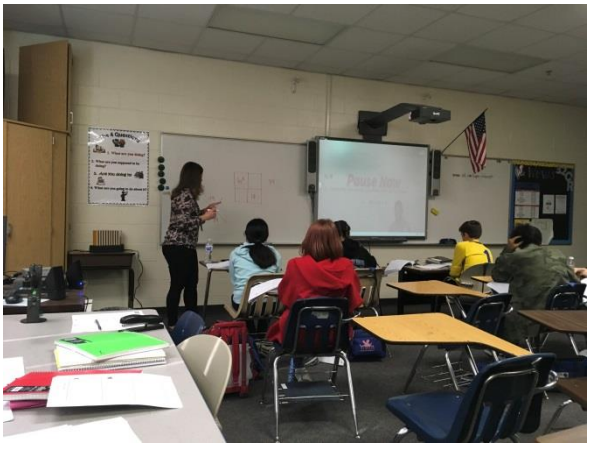
Mrs. Porter reiterated the plan and points students to p. 134 of the Algebra Nation workbook. She indicated that she will co teach with Zach, the Algebra Nation video Study Expert on the quadratics solutions lesson.

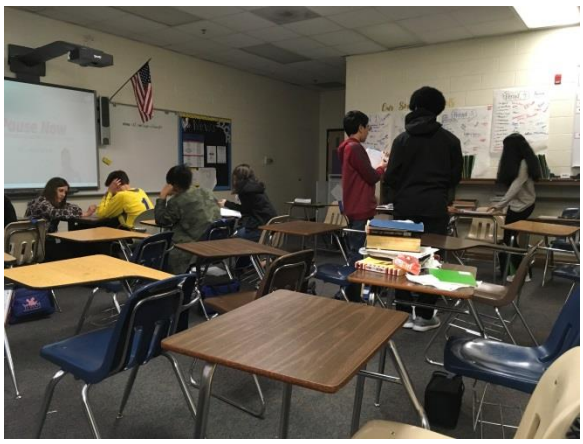


Mrs. Porter started the video lesson then paused after one minute to ask questions about the zero product property explained on the video by Zach. As a problem was posed on the video, she paused to explain factoring method that was used is different from what she had taught in the past. Mrs. Porter used a factor diamond and the video uses an area model method. She continued to run the video and paused to address the concept and ask questions about the first example.

The second example used the area model for factoring and Mrs. Porter contrasted the diamond method to the area model. She adeptly paused the video and discussed the two methods used. She asked students individually to solve the final two linear equations of the factored quadratic for the two solutions, then let Zach finish the problem on the video so students could compare their answers.

Zach posed a third example and Mrs. Porter indicated that students could use whichever method they preferred to solve the quadratic equation. Students seemed to prefer the diamond method. Mrs. Porter demonstrated both methods on the board.





Mrs. Porter next assigned a Best the Test problem from p. 126 of the Algebra Nation workbook where students were to find an error that Tyra made in solving a quadratic equation. She suggested that students solve the equation using their own method if they couldn't find the error that Tyra made. After about 5 minutes she asked students to share what they found with a neighbor. After 3 minutes of sharing she had students return to their seats and reviewed the errors using the video of Zach explaining.

Mrs. Porter next wanted them to apply the solution method for quadratics to real world situations involving a ball being thrown. She emphasized the importance of being able to apply algebra concepts they were learning to solve problems encountered in life. She made an effort to demonstrate how the graph over time is different from the image of the ball moving up and down anticipating a problem students were likely to have. She asked students to either individually or with a partner answer the question of how long it will take for the ball to hit the ground. Students worked on the problem, about half in pairs and half individually. They found the two solutions to the equation, one a negative number, and Mrs. Porter helped them determine that $t = 3$ was the time elapsed for the ball to hit the ground.

When the bell rang Mrs. Porter reminded students to watch the assigned video for homework and that what they learned on the video would be discussed in the next day's class.

12:30 to 1:20 Post Observation Conference

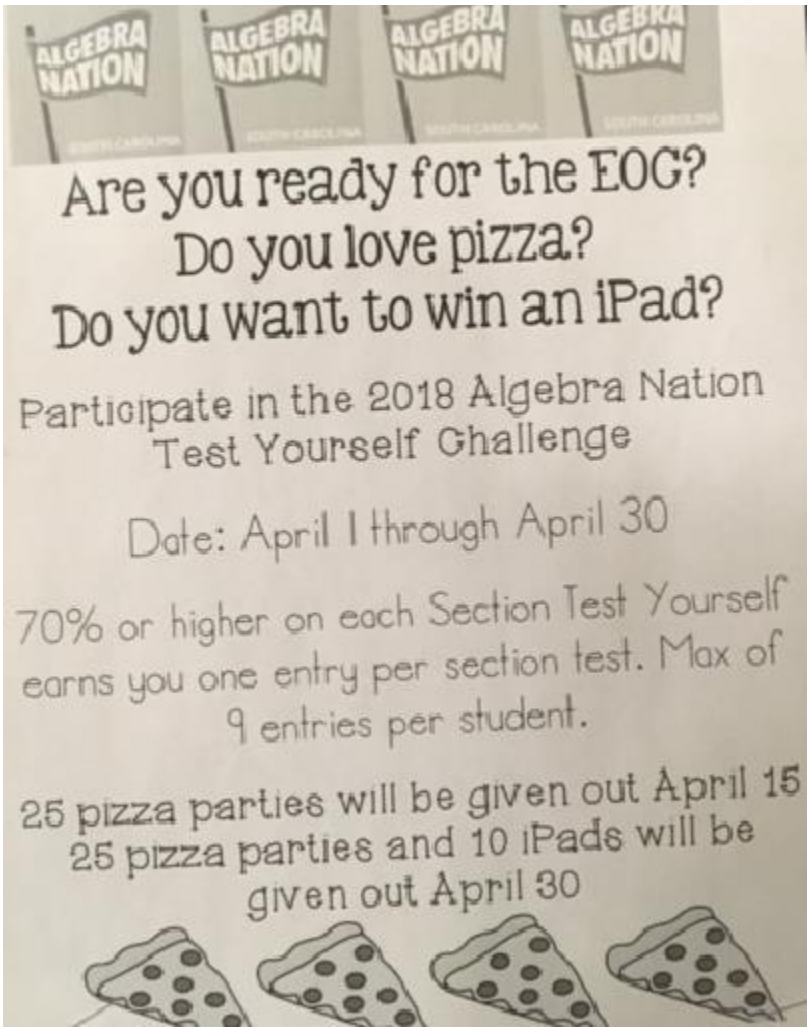
During Mrs. Porter's planning period, she and I discussed her use of Algebra Nation resources and their impact on her students. She indicated that she had used Algebra Nation two years earlier when she was a teacher in Florida. From that experience, she knew the resources had a positive impact on test score and student learning.

Mrs. Porter indicated that her students are sometimes assigned videos to be viewed outside of class and sometimes she uses the videos in class, co-teaching with the Study Expert, as she did in the lesson I observed. She determines based on content whether to "flip the class" and have the students' watch the lesson at home or whether to use the video as part of in-class teaching. If the material is familiar to students, she prefers to use the flipped class approach but for more challenging material, she prefers to co-teach.

Mrs. Porter mentioned that she values being able to share different teaching styles and mathematical perspectives with her students. She felt she had grown as a teacher through the Algebra Nation use of the area model for factoring as well as other teaching methods she experiences through the videos. She also indicated that starting in Florida, using Algebra Nation had helped her give more attention to students' conceptual understanding and moved her away from teaching procedures almost exclusively. She appreciates the inclusion of real world situations tied to problems.

Mrs. Porter uses many of the resources in the Teacher Area. She cited the value of the Independent Practice worksheets as well as the Mini Assessments. She has increased her use of

Test Yourself! Practice with the approach of the administration of the end-of-course Algebra 1 test. The poster below was at the front of her classroom. Her students seem to make use of the Algebra Wall and she indicated that she has found it very beneficial as she is not always available to answer questions or help.



Mrs. Porter indicated that she has grown to depend heavily on the instructional materials provided through Algebra Nation. She felt her students and she would be negatively impacted if she was no longer able to use the resources she has come to value.

MCOP^2 Form for Jennifer Porter

Jennifer Porter / EL Wright Middle / Alg I Grade 7 / March 28, 2018

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

1) Students engaged in exploration/investigation/problem solving.

SE		Description
3		Students regularly engaged in exploration, investigation, or problem solving. Over the course of the lesson, the majority of the students engaged in exploration/investigation/problem solving.
2		Students sometimes engaged in exploration, investigation, or problem solving. Several students engaged in problem solving, but not the majority of the class.
1		Students seldom engaged in exploration, investigation, or problem solving. This tended to be limited to one or a few students engaged in problem solving while other students watched but did not actively participate.
0		Students did not engage in exploration, investigation, or problem solving. There were either no instances of investigation or problem solving, or the instances were carried out by the teacher without active participation by any students.

Comments: All students investigate solving methods as solved a problem about half the class.

2) Students used a variety of means (models, drawings, graphs, concrete materials, manipulatives, etc.) to represent concepts.

SE		Description
3		The students manipulated or generated two or more representations to represent the same concept, and the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were explicitly discussed by the teacher or students, as appropriate.
2		The students manipulated or generated two or more representations to represent the same concept, but the connections across the various representations, relationships of the representations to the underlying concept, and applicability or the efficiency of the representations were **not** explicitly discussed by the teacher or students.
1		The students manipulated or generated one representation of a concept.
0		There were either no representations included in the lesson, or representations were included but were exclusively manipulated and used by the teacher. If the students only watched the teacher manipulate the representation and did not interact with a representation themselves, it should be scored a 0.

Comments: symbolic & graphical representations were both addressed

3) Students were engaged in mathematical activities.

SE		Description
3		Most of the students spend two-thirds or more of the lesson engaged in mathematical activity at the appropriate level for the class. It does not matter if it is one prolonged activity or several shorter activities. (Note that listening and taking notes does not qualify as a mathematical activity unless the students are filling in the notes and interacting with the lesson mathematically.)
2		Most of the students spend more than one-quarter but less than two-thirds of the lesson engaged in appropriate level mathematical activity. It does not matter if it is one prolonged activity or several shorter activities.
1		Most of the students spend less than one-quarter of the lesson engaged in appropriate level mathematical activity. There is at least one instance of students' mathematical engagement.
0		Most of the students are not engaged in appropriate level mathematical activity. This could be because they are never asked to engage in any activity and spend the lesson listening to the teacher and/or copying notes, or it could be because the activity they are engaged in is not mathematical – such as a coloring activity.

Comments: All students were engaged in several math activities

4) Students critically assessed mathematical strategies.

SE	TF	Description
3	3	More than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
2	2	At least two but less than half of the students critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher.
1	1	An individual student critically assessed mathematical strategies. This could have happened in a variety of scenarios, including in the context of partner work, small group work, or a student making a comment during direct instruction or individually to the teacher. The critical assessment was limited to one student.
0	0	Students did not critically assess mathematical strategies. This could happen for one of three reasons: 1) No strategies were used during the lesson; 2) Strategies were used but were not discussed critically. For example, the strategy may have been discussed in terms of how it was used on the specific problem, but its use was not discussed more generally; 3) Strategies were discussed critically by the teacher but this amounted to the teacher telling the students about the strategy(ies), and students did not actively participate.

Comments: Students assessed different methods for solving. Teacher asked to vote on method used.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

5) Students persevered in problem solving.

SE	Description
(3)	Students exhibited a strong amount of perseverance in problem solving. The majority of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), the majority of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
2	Students exhibited some perseverance in problem solving. Half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem.
1	Students exhibited minimal perseverance in problem solving. At least one student but less than half of students looked for entry points and solution paths, monitored and evaluated progress, and changed course if necessary. When confronted with an obstacle (such as how to begin or what to do next), at least one student but less than half of students continued to use resources (physical tools as well as mental reasoning) to continue to work on the problem. There must be a road block to score above a 0.
0	Students did not persevere in problem solving. This could be because there was no student problem solving in the lesson, or because when presented with a problem solving situation no students persevered. That is to say, all students either could not figure out how to get started on a problem, or when they confronted an obstacle in their strategy they stopped working.

Comments

Students persisted to solve) to find focus in methods

6) The lesson involved fundamental concepts of the subject to promote relational/conceptual understanding.

TF	Description
(3)	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, and the teacher/lesson uses these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
2	The lesson includes fundamental concepts or critical areas of the course, as described by the appropriate standards, but the teacher/lesson misses several opportunities to use these concepts to build relational/conceptual understanding of the students with a focus on the "why" behind any procedures included.
1	The lesson mentions some fundamental concepts of mathematics, but does not use these concepts to develop the relational/conceptual understanding of the students. For example, in a lesson on the slope of the line, the teacher mentions that it is related to ratios, but does not help the students to understand how it is related and how that can help them to better understand the concept of slope.
0	The lesson consists of several mathematical problems with no guidance to make connections with any of the fundamental mathematical concepts. This usually occurs with a teacher focusing on procedure of solving certain types of problems without the students understanding the "why" behind the procedures.

Comments

Mrs Parker emphasized conceptual understanding about solving quadratic equation

7) The lesson promoted modeling with mathematics.

TF	Description
3	Modeling (using a mathematical model to describe a real-world situation) is an integral component of the lesson with students engaged in the modeling cycle (as described in the Common Core State Standards).
(2)	Modeling is a major component, but the modeling has been turned into a procedure (i.e. a group of word problems that all follow the same form and the teacher has guided the students to find the key pieces of information and how to plug them into a procedure.); or modeling is not a major component, but the students engage in a modeling activity that fits within the corresponding standard of mathematical practice.
1	The teacher describes some type of mathematical model to describe real-world situations, but the students do not engage in activities related to using mathematical models.
0	The lesson does not include any modeling with mathematics.

Comments

modeling was addressed - but bell toss problem

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

8) The lesson provided opportunities to examine mathematical structure. (symbolic notation, patterns, generalizations, conjectures, etc.)

TF	Description
3	The students have a sufficient amount of time and opportunity to look for and make use of mathematical structure or patterns.
2	Students are given some time to examine mathematical structure, but are not allowed adequate time or are given too much scaffolding so that they cannot fully understand the generalization.
1	Students are shown generalizations involving mathematical structure, but have little opportunity to discover these generalizations themselves or adequate time to understand the generalization.
0	Students are given no opportunities to explore or understand the mathematical structure of a situation.

Comments: Teacher asked. Structure of quadratic factoring using Bar Test exam. [illegible] area model.

9) The lesson included tasks that have multiple paths to a solution or multiple solutions.

TF	Description
3	A lesson which includes several tasks throughout; or a single task that takes up a large portion of the lesson; with multiple solutions and/or multiple paths to a solution and which increases the cognitive level of the task for different students.
2	Multiple solutions and/or multiple paths to a solution are a significant part of the lesson, but are not the primary focus, or are not explicitly encouraged; **or** more than one task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
1	Multiple solutions and/or multiple paths minimally occur, and are not explicitly encouraged; **or** a single task has multiple solutions and/or multiple paths to a solution that are explicitly encouraged.
0	A lesson which focuses on a single procedure to solve certain types of problems and/or strongly discourages students from trying different techniques.

Comments: Tasks given were standard questions [illegible] to their higher level given an application

10) The lesson promoted precision of mathematical language.

TF	Description
3	The teacher "attends to precision" in regards to communication during the lesson. The students also "attend to precision" in communication, or the teacher guides students to modify or adapt non-precise communication to improve precision.
2	The teachers "attends to precision" in all communication during the lesson, but the students are not always required to also do so.
1	The teacher makes a few incorrect statements or is sloppy about mathematical language, but generally uses correct mathematical terms.
0	The teacher makes repeated incorrect statements or incorrect names for mathematical objects instead of their accepted mathematical names.

Comments: Also spoke appropriate vocabulary & was corrected when [illegible]

11) The teacher's talk encouraged student thinking.

TF	Description
3	The teacher's talk focused on **high levels** of mathematical thinking. The teacher may ask lower level questions within the lesson, but this is not the focus of the practice. There are three possibilities for high levels of thinking: analysis, synthesis, and evaluation. ***Analysis :*** examines/ interprets the pattern, order or relationship of the mathematics; parts of the form of thinking. **Synthesis**: requires original, creative thinking. **Evaluation**: makes a judgment of good or bad, right or wrong, according to the standards he/she values.
2	The teacher's talk focused on **mid-levels** of mathematical thinking. **Interpretation**: discovers relationships among facts, generalizations, definitions, values and skills. **Application**: requires identification and selection and use of appropriate generalizations and skills
1	Teacher talk consists of **"lower order"** knowledge based questions and responses focusing on recall of facts. **Memory**: recalls or memorizes information. **Translation**: changes information into a different symbolic form or situation.
0	Any questions/ responses of the teacher related to mathematical ideas were rhetorical in that there was no expectation of a response from the students.

Comments: High levels of thinking were used to evaluate solution methods

12) There were a high proportion of students talking related to mathematics.

SE	Description
3	More than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
2	More than half, but less than three quarters of the students were talking related to the mathematics of the lesson at some point during the lesson.
1	Less than half of the students were talking related to the mathematics of the lesson.
0	No students talked related to the mathematics of the lesson.

Comments: All students [illegible] expected of group pair work.

Mathematics Classroom Observation Protocol for Practices (MCOP^2)

13) There was a climate of respect for what others had to say.

SE	TF	Description
(3)	(3)	**Many** students are sharing, questioning, and commenting during the lesson, including their struggles. Students are also listening (active), clarifying, and recognizing the ideas of others.
2	2	The environment is such that **some** students are sharing, questioning, and commenting during the lesson, including their struggles. Most students listen.
1	1	Only a **few** share as called on by the teacher. The climate supports those who understand or who behave appropriately. **Or** Some students are sharing, questioning, or commenting during the lesson, but most students are actively listening to the communication.
0	0	No students shared ideas.

Comments: Mrs Porter questio[illegible] students to elicit information about their thinking

14) In general, the teacher provided wait-time.

SE	Description
(3)	The teacher **frequently** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
2	The teacher **sometimes** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
1	The teacher **rarely** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.
0	The teacher **never** provided an ample amount of "think time" for the depth and complexity of a task or question posed by either the teacher or a student.

Comments: Several points in the lesson required students to think & work silently

15) Students were involved in the communication of their ideas to others (peer-to-peer).

SE	Description
(3)	**Considerable** time **(more than half)** was spent with peer to peer dialog (pairs, groups, whole class) related to the communication of ideas, strategies and solution.
2	**Some** class time **(less than half, but more than just a few minutes)** was devoted to peer to peer (pairs, groups, whole class) conversations related to the mathematics.
1	The lesson was primarily teacher directed and little opportunities were available for peer to peer (pairs, groups, whole class) conversations. A few instances developed where this occurred during the lesson but only lasted less than 5 minutes.
0	No peer to peer (pairs, groups, whole class) conversations occurred during the lesson.

Comments: Students were paired to compare results & Beat the clock problem

16) The teacher uses student questions/comments to enhance conceptual mathematical understanding.

TF	Description
(6)	The teacher **frequently** uses student questions/ comments to coach students, to facilitate conceptual understanding, and boost the conversation. The teacher sequences the student responses that will be displayed in an intentional order, and/or connects different students' responses to key mathematical ideas.
2	The teacher **sometimes** uses student questions/ comments to enhance conceptual understanding.
1	The teacher **rarely** uses student questions/ comments to enhance conceptual mathematical understanding. The focus is more on procedural knowledge of the task verses conceptual knowledge of the content.
0	The teacher **never** uses student questions/ comments to enhance conceptual mathematical understanding.

Comments: Mrs Porter constantly sought student input to increase conceptual understanding

Additional Notes: Preservice or Inservice. Live or Video. #Students, Grade Level, topic/subject, date, other demographics, school, etc.

Mrs Porter co-taught second of the lesson content with Alg Nation Study Expert Zac allowing her to monitor student understanding & engage different methods for solving quadratic equations. She used a real world example for the Alg Nation students to initiate activity.